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Cyanide Poisoning

—Successful Treatment of Two Cases with Intravenous Sodium Nitrite and Sodium Thiosulfate—

ALFRED P. INGEGNO, M.D.,
and
SAVERIO FRANCO, M.D.,
Brooklyn, New York

WE ARE prompted to report these two cases of cyanide poisoning because of the increasing number of deaths from this cause, and a very effective method of treatment with intravenous sodium nitrite and sodium thiosulfate developed experimentally by Hug[2,5] and by Chen[6]. In the past three years there have been reports of three cases of KCN intoxication successfully treated by this method.[7,8] Up to April, 1937, no reports were available of the clinical treatment of HCN gas poisoning with these antidotes[9] so that Case 1 probably constitutes the first of this type so treated.*

Report of Cases

CASE 1. J. T., aged 20, a white, single, Italian-American laborer, was assisting in the removal of small trucks loaded with cotton from a large fumigating tank which had recently been filled with HCN gas. He had moved out two of the trucks and was moving out a third when he noted a smell of gas, felt a constriction in his neck that made it impossible for him to breathe, and lost consciousness. This happened at about 10 A.M. on April 8, 1937. At about 10:15 A.M. he was found by fellow-workers, unconscious and not breathing. Artificial respiration was immediately started. At 10:45 A.M., the ambulance surgeon arrived and found the patient unconscious, flaccid, and markedly cyanotic. Respiration was being maintained artificially, the pupils were contracted, the pulse rapid and weak. Adrenalin was given, and shortly after, carbogen was administered by an emergency squad.

By 12:15 P.M. his respirations were spontaneous and his color was pink although he was still unconscious. Periods of marked restlessness alternated with intervals of quiet. At 12:30 P.M., he was brought to the hospital accident room. Bursts of violence were so severe that restraint by several men was required. The color was slatey, and the respirations were deep and somewhat accelerated. Inhalations of amyl nitrite were given, and then 300 mg. of sodium nitrite in 10 cc. water intravenously. This was followed immediately, through the same needle, by 2 gm. of sodium thiosulfate in 50 cc. of water. There was no immediate change in the patient's condition. Coramine and caffein-sodiobenzoate were given and the patient transferred to the ward.

At 1:30 P.M., he would open his eyes in response to call but did not answer. He vomited bile-stained material and had to be restrained at times. Cyanosis less; temperature, 99.2°; pulse 116; blood pressure 110/74, pupils reacted to light, knee jerks absent although ankle jerks obtained. At 2:15 P. M., half the original doses of nitrite and thiosulfate were given, and by 4:00 P.M., his color was pink, pupils dilated and reacted, pulse 100, temperature 100.2, blood pressure 110/70. By 6:00 P.M., he was fully conscious and able to speak. His subsequent course was uneventful and he was discharged seven days after admission, completely recovered.

Laboratory findings: blood count (April 8, 1937) —R.B.C. 3,760,000, H. 89% (S), W.B.C. 18,000 with 86% P.M.N. Urine negative. Blood chemistry (April 9, 1937)—sugar 105, urea N. 13.6. Electrocardiograms were taken before, during, and after the second injection of sodium nitrite. The changes observed were slight and consisted in the development of slurring in QRS of L.2 and L.3. The T waves increased in voltage from 1½ to 2½ mm. and T_3 became diphasic. A very small Q_1 disappeared and a definite Q_3 of 20% developed. An electrocardiogram taken 20 minutes after the injection showed a disappearance of the above changes.

Spectroscopic examination of the blood (by DR. G. B. RAY, of the Department of Physiology) at 2:00 P.M., (one and one-half hours after the first injection) showed no abnormal blood pigments. A second specimen at 3:30 P.M. (one and one-quarter

* From the Department of Internal Medicine, Long Island College of Medicine and Long Island College Hospital.

hours after the second injection) showed 20% methemoglobin and 80% oxyhemoglobin.

CASE 2. L. H., aged 25, a white male commercial artist, was admitted at 10:00 A.M. on June 1, 1937. One hour before, he had accidentally taken one swallow of a strong solution of KCN. (The solution consisted of two ounces of KCN and one dram of iodin per pint of water and was used in photography.) He promptly felt very weak, began to vomit large quantities, experienced difficulty in breathing and lost consciousness. He was rushed to the hospital accident room where examination revealed him to be unconscious, of dusky hue, frothing at the mouth, and with labored respirations.

He was given inhalations of ammonia, and caffein subcutaneously, and aroused sufficiently to mutter "potassium cyanide" before again lapsing into unconsciousness. His stomach was washed out with hydrogen peroxide solution and more caffein was given hypodermically. There was some return of consciousness and at 11:00 A.M. he was transferred to the ward. There, examination showed difficult respirations, rapid pulse, a slatey color and tremors. At 11:20 A.M., he was given amyl nitrite inhalations and 300 mg. of sodium nitrite in 10 cc. of water intravenously. The latter was followed at once, through the same needle, by 25 cc. of 50% sodium thiosulfate (12.5 gm.). At 11:30 A.M., he was put in an oxygen tent.

Within a half hour after the first dose of nitrite and thiosulfate, his general condition improved to such an extent that he was complaining because he did not have a cigarette. After two hours, the tremors still being present, the intravenous medication was repeated in the same dosage. With both intravenous injections, he felt nauseated and complained of palpitation. By 1:00 P.M., his cyanosis was much improved. He was watched closely for 24 hours for any recurrence of symptoms. None appeared and he was discharged after three days, completely well.

Laboratory findings: leucocytosis of 16,600 with normal differential. Urine: trace of sugar and albumin, many W.B.C. and casts and a few R.B.C in the sediment. Blood Wassermann 3, Kahn 0 (6/2/37). Two rechecks (6/8/37) were negative. Blood chemistry normal. Spectrophotometric examination of the blood was not done until June 2, and at that time showed no methemoglobin, cyanhemoglobin, or other abnormal pigments. Analysis showed 14.62 gm. per cent of oxyhemoglobin.

Comment

THE history and clinical status of these patients leave no doubt as to the cause of intoxication. Both cases, but more particularly the one resulting from inhalation of HCN gas (Case 1), were instances of severe cyanide poisoning. The prognosis was unquestionably grave and although there was some restoration as a result of immediate nonspecific measures, the therapeutic efficacy of nitrite and thiosulfate in bringing about rapid and complete recovery cannot reasonably be denied. No serious side-effects resulted from the medication used although the following changes were noted:

1. Nausea and palpitation (Case 2);
2. Development of methemoglobinemia of 20% after two injections (Case 1);
3. Transient but definite electrocardiographic changes (Case 1).

SOURCES OF CYANIDE POISONING: [1,10]

1. Suicidal (over 90%)
2. Occupational
   - (a) Fumigation
   - (b) Photography
   - (c) Chemical laboratories and factories (manufacture of complex cyanides, etc.), gas works
   - (d) Electroplating
   - (e) Gilding
   - (f) Metallurgy
   - (g) Tanning and dyeing
3. Accidental
   - (a) Cyanide compounds
   - (b) Vegetable (bitter almonds, arrow grass, chokeberry, certain mushrooms)
4. Homicidal

MODE OF ACTION OF CYANIDES: [10] The poisonous action of cyanide consists essentially in an inhibition of tissue respiration. Hydrocyanic acid has a special affinity for the heavy metals; the iron of the catalysts concerned in cell respiration is bound by the poison and its necessary combination with oxygen prevented. Internal suffocation of the cells, especially in the respiratory center itself, is the result. This combination of cyanide with the respiratory enzymes is independent of oxygen and takes place even in an atmosphere of pure oxygen. In view of these facts and in contrast with what occurs in CO poisoning, oxygen is of little use in the therapeusis of cyanide intoxication. When taken by mouth, potassium cyanide is absorbed as hydrocyanic acid after being acted upon by the HCl of the gastric secretion. Small amounts of HCN are probably rapidly converted to nonpoisonous thiocyanate by the action of sulphur from protein breakdown. It is then excreted through saliva and urine.

SYMPTOMS OF CYANIDE POISONING: (a) Acute cyanide poisoning: Death may be practically immediate and sudden, or, if it does not occur for a few minutes, may be preceded by convulsions, unconsciousness, incontinence, and widely dilated pupils. Relatively small doses of potassium cyanide (0.1 to 0.2 gm.) cause, after about 10 minutes, giddiness, staggering, palpitation, thoracic oppression, agonizing dyspnea, and pupillary dilatation. Death occurs in from 20 to 40 minutes. Still smaller doses of KCN or inhalation of HCN in low concentrations (about 50 mg. per cu.m.) cause headaches, vomiting, thoracic oppression, and palpitation. A rosy color in spite of severe dyspnea and a bitter almond smell to the breath, are confirmatory. While a rosy color is emphasized by Leschke and should, theoretically, be present, cyanosis was outstanding in the two cases here reported and is also listed by Chen as an important sign. The per-

sonal or occupational history and environment, the presence of a cyanide container, and positive chemical tests for cyanide, have an obvious importance in establishing the diagnosis.

(b) Chronic poisoning, caused by absorption of small amounts of HCN over a long period, is characterized by headache, giddiness, tinnitus, throat irritation, palpitation, and, occasionally, temporary visual disturbances. There is no habituation but rather an increase in sensitivity to the poison.

IDENTIFICATION OF CYANIDE: In the untreated case of cyanide poisoning, cyanhemoglobin is not present in the bloodstream in sufficient quantity to permit easy detection by spectroscopic methods, particularly since the cyanhemoglobin band is very close to that for oxyhemoglobin. After treatment with nitrite and the consequent formation of considerable amounts of methemoglobin, the spectroscopic resolution of any cyanide-hemoglobin combination is even more difficult. These facts explain the negative results obtained in Case 1. [11]

However, the chemical identification of the poison is important from the medicolegal standpoint. There are several qualitative and quantitative methods of identification. The "Prussian-blue test" is sensitive in one part to 50,000 and is done as follows:

Reagents: (1) ferrous sulfate 1.5%; (2) ferric chloride, hydrochloric acid, sodium hydroxide, each 10%.

Procedure: The suspected fluid (blood, gastric contents, etc.) is alkalinized with two drops of sodium hydroxide. Add 2 cc. of ferrous sulfate and 1 cc. of ferric chloride. Warm the mixture and cautiously acidify with hydrochloric acid but avoid a great excess.

Interpretation: A blue precipitate shows the presence of hydrocyanic acid.

Postmortem specimens should be obtained before any embalming procedure, since the formaldehyde of embalming fluids forms glycollic acid in reacting with cyanides. This acid does not give the chemical reaction of the cyanides.

THE ANTIDOTE: The combination of sodium nitrite and sodium thiosulfate intravenously has been shown to be a most effective antidote in cyanide poisoning.[5,6] Experimentally[6] it protected dogs against 20 M.L.D. of 4-10% sodium cyanide injected subcutaneously and had 10 times the protective power of methylene blue. Inhalations of amyl nitrite alone protected against 4 M.L.D. and the combination of amyl nitrite and sodium thiosulfate against 10 M.L.D. The action of sodium nitrite is prompt, that of sodium thiosulfate is comparatively slow.

A tentative explanation of the mode of action of nitrite-thiosulfate in detoxication is given by Chen:

$$\text{Nitrite} + \text{Hemoglobin} \rightarrow \text{Methemoglobin} \quad (1)$$

$$\text{Methemoglobin} + \text{Cyanide} \rightleftarrows \text{Cyanmethemoglobin} \quad (2)$$

The cyanide combines with the iron of the methemoglobin molecule to form cyanmethemoglobin which is apparently much less toxic than the cyanide. The actual detoxification involves conversion of cyanide to sulphocyanate, a relatively harmless radical:

$$\text{Thiosulfate} + \text{Cyanide} + \text{Oxygen} \rightarrow \text{Sod. Sulfocyanate} + \text{Sod. Sulfate} \quad (3)$$

The sulphur of this reaction is furnished by the body (cystein, glutathion, etc.) if nitrite alone is used. In the method of treatment recorded, the sulphur is supplied mainly by the thiosulfate. Reaction 2 may be reversible so that free cyanide ions may reappear and cause a recurrence of symptoms if part of the thiosulphate has meanwhile been eliminated. Hence the frequent necessity for repetition of the antidotes and careful observation for 24 to 48 hours.

METHOD OF TREATMENT:[1,10] (1) Keep the breathing and circulation going by artificial respiration and stimulation (caffein, coramine, glucose, etc.).

2. Amyl nitrite inhalations at once, every two to three minutes for 15 to 30 seconds.

3. Intravenous sodium nitrite (0.3 gm. in 10 cc. of water) at rate of 2.5 to 5 cc. per minute.

4. Follow immediately, through the same needle, with sodium thiosulfate (25 to 50 cc. of a 50% solution) at the same rate. Do not mix the nitrite and thiosulfate before administration.

5. Gastric lavage (if poison was taken by mouth) with 3% hydrogen peroxide or 0.2% potassium permanganate.

6. If signs reappear or persist, repeat one-half the dose of antidotes one hour later. A prophylactic second dose may be given two hours after the first even though the patient's condition does not especially indicate repitition.

7. Continuous observation for 24 to 48 hours.

Summary and Conclusions

TWO cases of cyanide poisoning are reported, one from inhalation of hydrocyanic acid, the other following the ingestion of potassium cyanide. Both cases were treated with sodium nitrite and sodium thiosulfate intravenously with complete recovery. This method of therapy has been successful in animal experiments. The recovery in these two cases and in three cases reported in the literature indicates a similar clinical efficacy.

[The authors wish to thank DR. K. K. CHEN, of the Lilly Research Laboratories, for his courtesy in their communication with him, and DR. G. B. RAY, of the Department of Physiology, for his cooperation in the performance and interpretation of the spectrophotometry.]

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Nephrolysis, Ureterolysis and Nephropexy

—Analysis of Seventy-Six Patients Operated Upon by a Similar Technic—

VINCENT J. O'CONOR, M.D.,
Chicago

THERE is probably no subject in medical literature which has given rise to such extreme divergence of opinion as the relative importance of abnormal renal mobility as an etiological factor in the production of lumbar abdominal and pelvic pain.*

In more recent years the association of faulty ureteral or renal pelvic drainage with the persistence or recurrence of renal infection, the formation of calculi and the development of hydronephrosis has furnished additional study and controversy among those most interested in these subjects.

With the marked improvement in modern methods of urological diagnosis, notably the procedure of clearly outlining the ureter and renal pelvis with opaque material in the roentgenogram, it might seem that sufficiently accurate data could be obtained to decide whether or not, in a carefully studied patient, abnormal renal mobility actually resulted in distressing or damaging sequelae.

On the contrary, additional information of obstructive processes in and about the ureteral lumen has complicated the diagnostic picture until the subject of movable kidney cannot be considered apart from such lesions as are tabulated under the headings of ureteral stricture, ureteral kinks, angulation of the ureter, renal torsion, and early hydronephrosis. Furthermore the interpretation of ureteropyelograms by the most experienced observers varies so greatly that when the various opinions are correlated with the idea of fairly analyzing the diagnostic and therapeutic problems of ureteral obstruction, whatever the underlying cause may be, one finds himself obliged to turn to an analysis of personal experience to arrive at a satisfactory conclusion.

In the light of these more modern methods of urological diagnosis, it has been interesting to note that surgeons having primary interest in urinary tract surgery have gradually come to a new recognition of the value of operative measures which would free the kidney and ureter and restore pelvic and ureteral drainage by proper fixation of the kidney itself. The indications for such operative interference in these instances are based upon accurate observation of urologic data and not upon the ordinary physical findings which formerly led to unnecessary surgery and a resultant widespread repudiation of so-called nephropexy or kidney fixation.

Kelly, Burford, Mathe, Fowler and others in this country, have recently reported in detail their successful treatment of "ptosis" of the kidney. In these patients accurate urographic findings confirmed the indications for operation. Kolischer has emphasized the value of nephrolysis and ureterolysis, as first described by Rovsing, with similar effect in these patients.

The constantly increasing number of reports by leading urologists, both at home and abroad, supports the fact that, in carefully studied cases, a suitable technic for freeing and fixing the kidney is followed by a highly satisfactory result which could not be obtained by other therapeutic procedures.

The occasion of this report necessitates a brevity which precludes an extensive resumé of the literature and any attempt at detailed study of individual case reports. The roentgenographic data and follow-up analysis, which is complete in each instance, will be limited to a few illustrations and a generalized summary.

This contribution is based upon a careful study of 76 consecutive operations for the relief of malposition of the kidney and ureter, associated with faulty drainage, persistent urinary infection or early hydronephrosis and clinically manifested by lumbar, abdominal or pelvic pain with or without objective or subjective symptoms referable to the urinary tract.

Incidence

IN 4,896 routine hospital urological examinations conducted to determine the possibility of *upper* urinary tract pathology the diagnosis of abnormal mobility of the kidney was recorded in 231 patients; 219 of these were females and 12 were males. The clinical situation prompted advice for operative intervention in 92 of these individuals. Seventy-six of these accepted operation, eight are still under observation and eight did not return for further advice. Of the eight still under my care, seven have had no relief from nonoperative therapy and two are partially improved after complete progressive dilatation of the ureter.

Of the 76 patients upon whom nephrolysis, ureterolysis and nephropexy was performed by the technic to be described, 73 were females and three males.* The only point of interest as to etiology was that 13 of these patients dated the onset and course of their trouble so intimately with mechanical injury and the operative findings so closely tallied with this supposition, that they have been definitely classed as traumatic in origin.

* Read before the Congress of Railway Surgeons, Palmer House, Chicago, September 20, 1937.

* H. H. YOUNG states that in 12,000 males admitted to the Brady Clinic, nephropexy was performed 10 times with relief.

We cannot, of course, overlook the fact that in these individuals there were undoubtedly predisposing factors which made this traumatic displacement possible. In this regard it is interesting to note that Kelly found a history of injury in only 13 of 242 cases diagnosed as movable kidney causing clinical symptoms.

Of these 76 patients, the right kidney was displaced in 69, the left in four (definite trauma), and bilateral in three (one definitely traumatic in origin). Forty-two had infection of the affected kidney and 26 of these had been previously treated by removal of foci of infection, renal lavage and ureteral dilatation. In 36 patients ureteral dilatation and conservative measures were carried out by me for periods of six months to three years without obtaining permanent relief of pain or urinary infection when present. Thirty-two of these patients had been previously operated upon for the same complaint cited at the time they first came under my observation. In no instance had relief been obtained. In 23 the appendix had been removed, in five operation for fixation of the uterus had been done and four had had gall-bladder explorations without removal.

Method of Diagnosis

URETERAL catheterization with complete analytical and bacteriological examination of the divided urine was performed in every instance in addition to pyelo-ureterography in both the recumbent and upright positions. Since the work of Goldstein on fractional ureterography, 40 of these patients have had careful studies as to the emptying time of the pelvis and ureter. I consider this additional information as of great aid in deciding whether pelvic or ureteral stasis should be relieved by ureteral dilatation alone, operation alone, or combined dilatation and operation. In the 40 so studied, the pelvis showed an emptying time of from 13 to 66 minutes. The normally draining ureter and pelvis is usually emptied of opaque material in from six to eight minutes and we consider a retention after 10 minutes as definitely abnormal. The patient is kept in the upright position during these observations.

The tip of the ureteral catheter was always kept in the lower ureter during the instillation of the opaque solution (12.5% sodium iodid) and was then completely removed while fractional ureteropyelograms were being made.

From my observations of these patients both roentgenological and anatomical, I am inclined to believe that ptosis of the kidney in itself is merely a contributory factor in the development of ureteral and pelvic stasis. When there are no abnormal peri-pelvic or peri-ureteral attachments or adhesions, the free course of pelvic or ureteral drainage seems rarely interrupted. But when sclerotic adhesions or posterior peritoneal attachments result in compression or angulation of the ureter in its course from the pelvis to the bladder, the descent or rotation of the kidney results in obstruction and angulation at these areas. These findings are frequently, but not always, confirmed at operation if great care is taken in the process of freeing the pelvis and ureter from their surrounding attachments. I believe it is for this reason that ureteral dilatation by bougies introduced within the lumen of the ureter gives only temporary or no relief of the obstruction in this type of pathology.

The technic of operation must therefore include not only a proper replacement of the kidney in a position as nearly that of the normal as is possible but must also provide for a complete freeing of the kidney, kidney pelvis and ureter from surrounding attachments, before the restoration of position is attempted.

Of the 76 patients operated upon, abnormal peri-ureteral or pelvic attachments were demonstrated in 26. In 18 there was a persistent lobulation of the kidney and in 12 an anomalous or bipolar blood supply. In none of these latter instances was there ureteral or pelvic compression from the anomalous vessels such as we have frequently seen in more marked hydronephroses. In five instances there was a complete reduplication of the pelves and ureters.

The surgical technic adopted in these cases combines complete ureterolysis and nephrolysis (freeing of kidney and ureter) and suspension or fixation by a method which I have found to insure most satisfactorily a high fixation of the kidney. An incision is made just below and paralleling the anterior half of the twelfth rib. It is then carried downward and forward and need not exceed five inches in length. The kidney is freed in the usual manner and *all fatty tissue* about the kidney and in the renal fossa is excised. The pelvis and ureter are carefully separated from all surrounding attachments, the latter being isolated down to the bifurcation of the iliac vessels. The kidney is completely freed so that the pedicle can also be isolated from any adherent structures. The true capsule is then incised both anteriorly and posteriorly at the upper hole and reflected carefully down to the region of the hilus. If this is done gently, no cortical tissue will be torn off with the capsule. The lower pole capsule is incised and reflected upward in a similar manner. This leaves a band of true capsule about two inches wide surrounding the middle third of the kidney. The capsular layers are then overlapped so that three thicknesses are available for the placing of suspension sutures. A U-shaped interlocking continuous suture of No. 2 chromic catgut is then placed through the three capsular layers from the convexity toward the hilus both anteriorly and posteriorly. The ends of these sutures are left from six to eight inches long so that they may be easily carried above the exposed portion of the twelfth rib. The strength of these suspending ligatures when placed in this manner is very great and they can be tested by traction to show that no separation of capsule will result when they are placed under tension. The kidney is then displaced downward in the wound and the renal fossa is enlarged by blunt stretching with moist gauze packs. The posterior ten-

sion sutures are then first carried under and above the twelfth rib as far toward the costovertebral angle as possible. When these are in place the anterior sutures are also carried under and above the twelfth rib an inch or two in front of the sutures from the posterior side of the kidney. The kidney is then pushed up firmly beneath the diaphragm and the elevation apparatus on the table is lowered. While the kidney is held in position, the sutures are pulled up firmly and tied simultaneously above the rib. The remaining strands of all four are again tied. This procedure serves to hold the partially decapsulated kidney in such a position that adhesions to the psoas muscle and diaphragm are inevitable. The suspending sutures are merely temporary insurance that the kidney will be held in a proper high position while adhesions are being formed. No further "anchoring" of the kidney is necessary and the usual closure can be made without drainage.

No elevation of the foot of the bed as a postoperative postural aid was used in this series. All patients were allowed to sit up in bed on the fourteenth postoperative day and to walk about without belts or corsets as soon after this time as their general condition warranted. Each one of the 76 patients walked out of the hospital in from 16 to 20 days postoperative.

Clinical Results

FIFTY-EIGHT of these patients have been seen and examined in the past three years. The remaining 18 have written me or have been reported upon by their physicians since January 1. The duration since operation is as follows:

12 years	4 patients	5 years	9 patients
10 years	8 patients	4 years	8 patients
8 years	6 patients	3 years	12 patients
7 years	4 patients	2 years	13 patients
6 years	6 patients	1 year	6 patients

Symptomatically these patients classify their result as follows: Completely well, 58 patients; greatly improved, eight patients; somewhat improved, six patients; not improved, four patients.

When asked if they were glad they had had this operation, 60 replied in the affirmative, eight "did not know", and four replied in the negative. There was no reply from four.

Summary

FREEING of the kidney and ureter and suspension of the kidney (nephrolysis, ureterolysis and nephropexy) is an efficient and justifiable operative procedure when applied to carefully studied individuals.

2. The diagnosis rests only upon accepted urologic procedures utilizing modern methods of ureteropyelography and consideration of upper urinary tract mechanics.

3. The mere presence of abnormal renal mobility is not to be considered pathological unless clinical and objective study demonstrates definite indication of deficient ureteral or pelvic drainage.

4. A satisfactory operative technic is described which varies from previously reported methods.

Non-Penetrating Traumatic Injuries of the Abdomen

EDWARD J. REILLY, M.D.,
Campbell, Ohio

THE RECEIPT of an invitation from your program committee to present a paper before this Association convention has given me considerable concern, particularly in the choice of subject matter.* Coming as I do from Campbell, Ohio, in the Mahoning Valley, or, as it has lately been re-christened the "Valley of Decision", which is an active industrial center, having many thousands engaged in more or less hazardous occupations, the thought was to limit my material to that type of injuries associated with industrial accidents. When I began to assemble data however, I found that accidents in industry that produce non-penetrating traumatic injuries of the abdomen were comparatively few, that the automobile is the chief offender, and that the victims are mostly children and the aged. Some general considerations will be presented, and then a description of trauma of each organ.

Any injury which the abdominal wall may suffer is of little consequence compared with the damage which may be sustained by the contents of the abdomen. Two conditions call for treatment: (1) the shock of concussion of the sympathetic plexuses; and (2) visceral injuries.

Sympathetic shock demands the same treatment as described for shock in general.

Visceral injuries demand diagnosis first. The surgeon should bear in mind that a slight contusion, confined to a small area is capable of causing laceration or rupture of viscera, and that this is especially the case with distended hollow viscera and with organs fixed by adhesions. The signs which guide the surgeon are those of peritoneal irritation and hemorrhage. During the first hours these are confusing, as hemorrhage may produce irritation of the peritoneum sufficient to give rigidity, while infection in its early stages gives none. Or the shock of peritoneal invasion by infection, before peritonitis has developed, may lower blood pressure and simulate hemorrhage.

The question to decide is: is there either peritoneal irritation or hemorrhage, if so the abdomen should be opened and the lesion sought. The rule should be: when in doubt, explore. Don't wait until you are sure. In most doubtful cases a lesion is found which demands surgical treatment to save a life.

The surgeon who occasionally opens an injured abdomen and finds no injury is much to be respected.

Contusion of the abdominal viscera is caused mainly by blows, crushing forces, falls, compression between heavy objects, and by blunt objects traveling through the air with considerable velocity. Severity of the injury is dependent upon

* Read at the Annual Meeting of the Association of Surgeons of the New York Central System, Cleveland, Ohio, September 14, 1937.

the amount of force exerted, the angle of impaction and the condition of the abdominal muscles. A detailed history of the etiological factor is of supreme importance in determining the amount of damage inflicted.

The solid organs are ruptured less often than the intestine; liver, spleen and pancreas less often than the kidneys. Organs softened by disease lacerate more easily than normal viscera. Severe contusion may rupture the gall-bladder.

In these patients who enter the hospital in shock following a severe contusion of the abdomen with injury to a viscera, treatment of shock must be coincident with preparation for operation. The application of external heat, the use of morphine, the subcutaneous or intravenous administration of fluid in a suitable form, will help to restore the blood pressure to a level of safety. If intra-abdominal hemorrhage is in progress it must be stopped as quickly as possible. The determination of this fact may be very difficult. The concentration of blood cells in the capillaries may give a misleading picture when estimating the number of red cells and the hemoglobin.

In general, symptoms and signs are as follows:

1. Shock—slight or severe according to the extent of injury.

2. Pain—generalized pain is present, but it is usually acute at the site of injury. In upper abdominal injury pain is aggravated by respiration. Leakage from a perforated stomach, duodenum or jejunum causes the greatest degree of pain. This increases with the amount of fluid liberated.

3. Nausea and vomiting—are frequently present even in minor injuries.

4. Diarrhea—is present when there is hemorrhage into the lumen of the bowel.

5. Fever—temperature is low at first; it may drop to 95° in the presence of hemorrhage.

6. Pulse—almost always increased. Sometimes in massive hemorrhage without intestinal tears the pulse will be slow for several hours, after which a sudden collapse may ensue, especially if the cavity is opened.

7. Respiration—increased, particularly in upper abdominal injury. Continuous rapid superficial respirations are diagnostic of visceral injury.

8. Rigidity—almost always present. Early it is limited to the area of injury. As peritoneal irritation develops it becomes general. If muscle spasm is at first absent and later becomes manifest, serious injury is indicated. This is also true of late appearance of localized tenderness.

9. Percussion—is of little value. Early, when a diagnosis should be made, little or nothing is elicited by it.

10. Hematology—in the presence of hemorrhage in the abdominal cavity, there will be progressive increase in leukocytes. Leukocytes respond rapidly to irritating elements from contents of hollow viscera. The hemoglobin and red cells are reduced.

11. X-ray diagnosis—x-ray examination can usually demonstrate pneumo-peritoneum. A fluid level may be seen when both fluid and air are present. X-ray examinations should be made at once if a suitable apparatus is available.

Unhappily there is no sign, symptom, or combination of these, sufficiently constant to be reliable in indicating the exact nature of the injury. Exploratory laparotomy is the safest diagnostic aid for effective treatment.

Kidney

IN GENERAL the kidney is seldom subjected to traumatic injury, probably because of its well protected position beneath the ribs. In extensive trauma to the abdomen and pelvis the laceration of the surrounding structures wil usually be so extensive that the damage to the kidney will, by comparison, be of small account. Indirect trauma is a cause of many renal injuries,—violent jolting, falls from considerable height, alighting upon the feet, and similar indirect forces, being the usual cause. Muscular action,—dodging, leaping, or heavy lifting—has been known to produce kidney rupture; and when the injury to the kidney has been brought about in this way it is very often unrecognized until the condition of the injured organ has become very serious.

Severe injury may result from very slight trauma—sometimes so trivial that the patient pays little or no heed to it at the time it occurs. The symptoms are often so slow in manifesting themselves that before hematuria or other signs appear he will have completely forgotten how or when he was injured. The damage done to the kidney by trauma may vary all the way from trivial tears of the fatty capsule, localized sub-capsular hemorrhage, slight contusion or laceration of the parenchyma, to rupture of the renal pelvis, extensive injury to the blood vessels, complete tearing apart of the organ or its reduction to a pulp. These injuries may or may not be complicated by additional damage to the peritoneum or other neighboring tissues. If the peritoneum has also suffered, as is likely the case, the board-like rigidity or "abdominal defense" commonly encountered in abdominal lesions will be manifested. Nausea and vomiting are also prone to occur. If the kidney alone has suffered injury these symptoms are not so likely to be in evidence; but if there chances to have been extensive loss of blood, taking the leukocyte count will reveal its rise to 20 or 30 thousand. If enough time has elapsed for infection to take place there may be elevation of temperature even as high as 105°. Shock will, of course, be in evidence in cases of extensive injury of surrounding structures, and also when the kidney is the only organ affected. The greatest danger is from hemorrhage, and in immediately fatal cases death is practically always attributed to this cause. Infection is almost as grave a danger; but if the patient comes promptly to the surgeon's attention, so that early exploration may be undertaken, even some badly damaged kidneys may be saved or restored to usefulness. As the infection is likely to take the form of a diffuse cellulitis, it is very difficult to control when once established. But if it is seen soon enough to be

sutured and properly drained, the chances of a favorable outcome are considerably enhanced.

In industrial accidents the question as to whether a kidney was healthy previous to the accident may have an important bearing on the matter of compensation, as it is well established that trauma where pathologic condition already exists is likely to do far more injury than to a kidney previously sound. Very careful examination may be necessary in order to establish the pre-existence of some disease or lesion of which the patient may very likely have been ignorant; for what is occasionally termed "the silent kidney" can harbor tuberculous infection, stones or even tumors without offering a single sign arresting enough to direct attention to the renal lesion.

Spleen

WOUNDS of the spleen are so commonly associated with injury of the diaphragm, stomach, liver or other viscera that treatment most usually embraces also a consideration of other structures. Lacerated wounds and rupture of the spleen are rapidly fatal unless immediate operation controls the bleeding. There is no characteristic sign or symptom. The injury is usually the result of a fall or some indirect violence transmitted directly to the spleen through the thorax or abdomen. The period of shock is usually of short duration and clears up before the period of hemorrhage begins. In some cases there is, after the recovery from shock, an interval of improvement before the onset of secondary relapse. During this latent period, the patient has some abdominal pain and will present signs of moderate abdominal injury, but not serious enough to cause alarm. Then comes the secondary hemorrhage, which may be fatal. The local signs resemble peritonitis. There is generalized or localized pain in left hypocondrium and pain referred to the left shoulder may be present. In the early stages there is often a leukocytosis without diminution of red cells or hemoglobin. Definite diagnosis is difficult.

Splenectomy is indicated when the wounds are multiple or when extensive crushing or laceration does not lend itself easily to treatment by suture. This is the surest way of controlling bleeding. The chief objection to it is that there is apt to be a temporary unbalancing of the hematapoetic system, which does not give the patient as good a chance for recovery as when the organ is left.

Pancreas

TRAUMATISM of the abdomen, resulting in the rupture of other viscera, should prompt inspection for a rupture of the pancreas. Extreme shock is the immediate result, but otherwise there are no definitely characteristic symptoms. Immediate suture of a rupture should be made. When the gland is crushed or pulpified, hemorrhage should be arrested either by suture or packing and drainage provided. Drainage of the pancreas, whether after traumatism, operations for tumor or incision for infection, is important. When the organ is wounded or incised pancreatic juice escapes. This juice has the power (1) to digest plastic exudate, and (2) to irritate the peritoneum. It also causes fat necrosis. Its pressure in the tissues or peritoneum greatly increases the danger of infection. Bacteria which would otherwise be destroyed, grow in the presence of this fluid. Drainage may fail to localize the infection because the enzymes of the pancreas break down the plastic barriers.

Stomach and Intestine

RUPTURE or laceration of the small intestine is more often found in the less movable portions; that is, the duodenum, first portion of the jejunum, and the lower ilium. These injuries are caused by two different types of force: (1) by compressing the intestine against the bony wall of the abdomen or pelvis; (2) the intestine may give way more or less completely at the point of junction of a fixed and movable as a result of being stretched beyond its potential elasticity. These accidents form a considerable portion of those likely to occur in the abdomen.

Rupture or laceration of the large intestine is more frequent about its less movable portion, which is the right colon.

Contusions of the intestine, without rupture, may produce ecchymoses or local paralysis of the bowel, or be associated with the shock due to contusions of the sympathetic nerves of the abdomen. If gangrene does not take place the intestine recovers and operation is not required. Both this condition and local paralysis require that the patient be watched for signs of peritonitis. Contusions and tears of the mesentery may produce massive hemorrhage first, and later, necrosis of the intestine.

Only a small portion of the stomach lies in direct contact with the anterior abdominal wall, the remainder being covered by intestine. Direct trauma is more likely to cause injury to the overlying small intestine. Extensive rupture of the stomach has been reported when violence was applied to an over-distended stomach, this rupture being of the bursting type,—that is, from within. Crushing injuries of the stomach, severe enough to cause laceration or rupture, are most always associated with fatal injury to adjacent organs. Extensive hematemesis is the only constant symptom and is the indication for surgical intervention; while in contusions of the stomach blood-streaked mucous may appear in the emesis.

Traumatic appendicitis is commonly agreed to be a non-existent entity. Cases are on record of perforation of appendiceal abscess following a kick or a blow to the abdomen, but in most of these cases there was history of previous pathology in the appendix. While injury may be the immediate cause of the abdominal catastrophe, I doubt the probability of acute appendicitis arising spontaneously from it.

Liver, Gall-Bladder, and Bile Ducts

RUPTURE or laceration of the liver is usually associated with crushing injury to the right thorax, although it is just as often caused by direct violence to the right hypocondrium or the

epigastrium. It is an injury peculiarly common to youth due to the large size and soft glandular consistency of the organ.

Lacerations more frequently affect the convex surface. These extend from before backward and are stellate in character. It is possible to have extensive laceration with the capsule remaining intact, this being accompanied by a sub-capsular hematoma. Central lacerations deep in the substance of the liver are rare. Before operation, contusions of the liver often can not be distinguished from rupture, as the outward signs may be the same because there actually are multiple minute lacerations. A patient who has received a sharp blow upon the liver region, who has local pain or pain radiating to the right shoulder, shows the signs of shock and internal hemorrhage in the presence of marked bradycardia should have the benefit of a small exploratory opening in the upper abdomen under local anesthesia. If no bleeding is going on the wound should be closed. Free blood being found in the abdomen, a search should be made for the lesion. The hemorrhage is apt to be aggravated by opening the abdomen, for which reason no time should be lost in checking the bleeding. This is important because the slowing effect on the pulse, of the absorption of extravasated bile may more than compensate for the pulse-rate-increasing effect of hemorrhage, and, notwithstanding an abdomen full of blood, the pulse may be slow.

Rupture of the gall-bladder alone is rare, unless it is greatly distended. The gall-bladder is said to withstand 100 pounds air-pressure before rupturing. If the gall-bladder is ruptured or lacerated its contents evacuate into the peritoneal cavity, that is, only the bile in the gall-bladder escapes, whereas, in rupture of the bile ducts there is extravasation of a considerable quantity and early appearance of jaundice. A biliary peritonitis results; not always of the sterile type. If infection existed in the gall-bladder or bile ducts, septic peritonitis will result.

Mortality Rate in Abdominal Trauma

THIS depends of course on the severity of the injury and the number of organs involved. Complete traumatic rupture of the stomach presents the highest mortality, almost 100%.

Rupture and lacerations of the liver, if extensive, cause death from hemorrhage in over 75%.

Extensive rupture of the colon causes death from peritonitis in 60%. Rupture of the small intestine and rupture of the spleen show more favorable results. Rupture of the spleen, if treated early, and if the organ is not enlarged by previous disease, shows a mortality not over 25%.

The mortality rate may be as low as 15% in laceration of the small bowel, unless there has been extensive separation of the mesenteric attachment.

The surgeon need not be concerned one way or another for his statistics, as most of the patients who die after operation should not be classified as operative mortality; they die despite operation. The surgeon should be concerned only to do the best thing that can be done for each patient, the thing that offers the best hope for recovery, and the statistics may be left to themselves.

The Role of the Physician

—in the Production of Traumatic Neurosis—

John N. Frederick, M.D.,
Pittsburgh, Pennsylvania

MEDICAL science has advanced far since the railway spine type of injuries was first introduced by Erichsen in 1866.* H. Oppenheim in 1892 used the term traumatic neurosis for the same type of symptoms. What name the Greeks had for it, I do not know, but I feel that since man has left his caves, and has lived in communities, neuroses of a traumatic nature have been on the increase. It is impossible to estimate the amount of disability produced by neuroses which follow injury, but any surgeon can easily recall case after case in which the diagnosis was unmistakable. The claim agents for any railroad or corporation are very conversant with this type of patient.

Traumatic neurosis is a term which everyone uses, but which few define. E. E. Mayer, in Tice's System, gives the following: A blanket title like the traumatic neuroses denotes all symptom-complexes referable to the nervous system not dependent upon organic lesions which have an injury or shock as the predominant causal factor. It is an easy explanation for all the psychic factors that develop following any injury, even though it is apparent to the most casual examiner that the physical injury could not produce all the subjective complaints, and emotional disturbances.

I wish to stress the role the medical man plays in aiding the patient build up the symptoms which are classified as traumatic neuroses. You no doubt will raise an eyebrow and question the fact that a physician at any time increases his patient's disability, but whether you agree or not, the fact remains. I am not speaking of the medical testifier working in league with some trial lawyer, who implants in the client's mind definite symptoms that are brought out at the subsequent trial. I am speaking of the physician who explains how easily the same accident has killed another man, or produced a permanent paralysis, builds up in the patient's mind the idea that he should have more injuries than are actually found. That is how the idea for the traumatic neurosis has its inception.

"That is only a simple fracture and will heal very quickly." "A couple of cracked ribs means a week from work." "That bump on the head might have killed someone, but it has not dented you a bit." Things similar to these have been said by many in the emergency room. Now the

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* Read at the Annual Meeting of the Association of Surgeons of the New York Central System, Cleveland, Ohio, September 14, 1937.

simple fracture heals as we expect, but the leg may swell after the cast is removed, the ankle joint may be partly ankylosed, the muscles show the atrophy of disuse, and the leg may not perform as it did before. The patient at first may be ashamed to complain, and when he does complain, the physician tells him he has nothing to worry about. "You are lucky you did not lose your leg." The man, ignorant of anatomy and physiology, does not know whether the physician is joking or in earnest. Either impression starts a train of thought about himself, and that is the fuel needed for increasing the neurosis.

Traumatic neurosis is usually looked upon as belonging to a particular type of individual. I have found that each and every one of us may be susceptible, and will react and show evidence of traumatic neurosis if a proper situation arises. This is natural, due to our habits of living. As children, we usually have considerable attention forced upon us, until our ego is well established. We are talked about in our presence, and urged to do and act when three years old, all the tricks that have been taught us by our fond relatives. At eight or nine we may be paddled or reprimanded for still attempting to "steal the show" or be the center of attraction. As we grow older we have periods in which we dominate a certain group, but we soon learn that we have to give the other fellow a chance to tell his story or do his act. When an injury occurs we again receive great consideration from our relatives and friends. We are talked about, visited, questioned and congratulated on escaping such a severe accident in such an easy manner, and, like in early childhood, we enjoy the situation even though we have some physical suffering to endure. The doctor not wishing to be outdone, wants his skill to be recognized, and tells the patient that he is lucky to have gotten away from such an accident with so little damage. Or inferring that, if it were not for the exceedingly skillful handling of the case, the patient would not be alive. Even if the surgeon is not egotistical enough to advance such a statement, he remains silent when the patient praises his medical adviser. This sets up a train of thought, subconsciously of course, in the individual, so that the patient himself begins to dwell upon all the factors involved in the injury. His memory is revived for all similar types of accidents. As a result, the incidents begin to grow in importance, and as the memory and emotional disturbances increase, symptoms and complaints also increase. The physician confronted with such complaints, dismisses them often times by a mere statement "you are lucky you do not have a lot more trouble." This adds fresh fuel to the already stimulated fires of the imagination, so that it is often seen that a patient's illness increases as the days go by.

You drive a golf ball 200 yards, and I promptly congratulate you for doing so. Then I proceed to drive my golf ball 210 yards, and even though you say nothing, I have a glow of satisfaction in knowing that you know that I know that a 200-yard drive is excellent for the average golfer, so that without you uttering a word, the praise I gave you is also bestowed upon myself. This same mechanism produces dire results with the physician and patient. In order to comfort the patient for his distress, the physician elaborates upon the injury, or the patient praises the physician to his friends, concerning the skill shown in repairing the bruised and broken body. "No one but Dr. X could have gotten such a good result out of such a bad injury." Dr. X is flattered. The patient is satisfied, but the germ of the idea that something serious has occurred to the patient's body at the time of injury, has been implanted in the patient's mind.

I HAVE a white male, T.C., 44 years old, laborer, who three months ago had a back strain in lifting a weight of 165 pounds. He was sent to a hospital, where he had his back strapped and was put to bed. The x-ray was negative, but the patient complained more and more, and was put on a fracture bed. Within a month, both legs were powerless: he complained bitterly when any nursing procedure was carried out, and an orthopedist decided to put on a body cast. The hot weather and the cast were a combination that actually did cause distress, as there were several areas where the cast rubbed, and perspiration caused other irritations. When the cast was removed the patient was showing atrophy of disuse, in addition to his subjective complaints. My examination revealed the functional nature of the case. Then an investigation by a hospital social worker revealed that this individual was having marital difficulties, and on several occasions in the shop had been reprimanded by his boss for not working as efficiently as he had in the past. This case, superficially, does not look as if the surgeon was at fault, but in reviewing the case the mere fact of holding him in a hospital simply because he had complaints was poor therapy. A thorough examination to disprove any serious damage, then sending him out as an ambulatory patient, would have prevented a simple trauma being enlarged into a case which undoubtedly will reach the compensation referee within the next six months. True, the physician's role was a passive one, as no evidence of the surgeon encouraging by word the building up of a neurosis was found, but the handling of the case could have been improved.

Another case: J.F.E., aged 59, fell between two box cars, from the roof of one of them. He suffered a certain number of contusions: a fracture of his right ankle, and fracture of the ninth dorsal vertebra, with no displacement or cord injury. I was not familiar with the case during his stay in the hospital, but saw him some months later, when he showed an inability to do his work, developed fear states, and was unable to do even four hours' office work, where he formerly had been active both at his desk and on the road. A careful examination showed the disturbance to be entirely in the emotional and psychic field. The

patient himself said that when first taken to the hospital, and the accident described, the resident physician stated "if you haven't a broken back, you are a lucky man". Later, similar statements were made in the man's presence when it was discovered that the jack-knifing of his body had produced no permanent damage. His fellow employees added their bit, and by the time the man's body had recovered, his mental attitude was such that he was unfitted for work. The time lost was about four times longer than it should have been.

These examples, sketchy as they are, indicate that careful thought should be given to the spoken word by the physician, so that erroneous ideas do not get into the patient's mind. The less one is told about himself, and the simpler the explanation of any distress he complains of, is in the end the better procedure.

Often a surgeon does obtain an excellent result from a very serious injury. He exhibits the patient, recites the history, shows the x-rays, to his colleagues, and the patient hears all the discussions. He understands little, but his mind grasps the idea that something about the case is unusual or remarkable, and a mentality is put to work dwelling upon itself and the result is always disastrous. Since many injuries cause a temporary stoppage of extrovert activities, the mind tends to introvert and enlarge the mishap, and the traumatic neurosis results. Most people have many misconceptions about their body and its functions. Physicians many times forget the limited knowledge of the layman, and give an explanation perfectly clear to the M.D. but very puzzling to their listener.

Physicians, as a rule, are always anxious to aid recovery, but many times, due to illy chosen words, cause considerable damage which lingers long after the original injury is healed. This is not done deliberately, but is due in a measure to our failure to understand mental reactions. We love to talk about our cases, and unfortunately we talk many times to an audience which not only fails to understand, but only remembers parts of the conversation. And it is only the parts they wish to remember, whether stressed or not by the physician, that often times do the damage. Let us therefore be always careful when discussing an injury, that the patient or the patient's relatives do not receive impressions and ideas that are harmful.

The Surgical Conduct of Abdominal Injuries

Fred W. Bailey, M.D.,
St. Louis, Missouri

DRS. DICKINSON and Reilly have so competently covered the etiology, diagnosis and prognosis of intra-abdominal injuries, both penetrating and non-penetrating, that I shall be content with a few remarks on surgical procedure when entrance has been justified and the pathology exposed.* The 10-minute limit will demand brevity, and technique will be curtailed.

Liver

LACERATIONS of the liver are usually multiple, spreading from the point of direct trauma; they may be countrecoup as in brain injury. The gall-bladder may be torn from its bed. Loss of both blood and bile follows in direct proportion to the extent of injury; where seepage is through small rents in Glisson's capsule, shock may be severe, but signs of hemorrhage and bile peritonitis may progress slowly. This type seldom requires operation. Intra-abdominal pressure often suffices to control the leak until repair is established, as liver oozing often ceases spontaneously. Where severe gaping rents occur, shock, signs of active hemorrhage and peritonitis with intense muscle spasm and rigidity demand packing or suturing by aid of the liver needle, using broad mattress suture, or packing of the liver from below against the costal arch and diaphragm. Dome injuries are rare except in perforating wounds and are usually controlled by diaphragm pressure. Local anesthesia is safest with transfusion or intravenous glucose continuous while operating.

Spleen

RUPTURE of the spleen, unless primarily fatal, offers a favorable prognosis, as the bleeding can be controlled by a pedicle clamp and removal conducted later after stabilization. Repair of a badly lacerated spleen is seldom justified. I have seen recurrent fatal hemorrhages in two cases thus conservatively treated. Diseased and enlarged spleen is more easily damaged by trauma. Intra-splenic lacerations may bleed slowly and continuously for several days, finally rupturing with rapidly fatal issue.

Kidney

A RUPTURED kidney offers a means of easy and early diagnosis, although hematuria alone does not justify exploration, the index for which must be determined by additional clinical symptoms. Radical treatment is seldom resorted to safely, for laceration of the artery or vein, or major pelvic tributaries, is rapidly fatal and when cortex alone is torn, blood loss is ordinarily not rapid and a more leisurely approach may be made for drainage or nephrectomy, after opposite kidney function is known.

Mesentery

MESENTERIC laceration when found may be so severe that resection is mandatory. If shock has been grave, hemorrhage severe and progressive even though the blood pressure is below 75, the remedy is to control the hemorrhages and thereby reduce shock. In extreme emergencies, the vessels may be clamped and the non-viable gut mikuliczized for resection after stabilization has been secured.

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* Read at the Annual Meeting of the Association of Surgeons of the New York Central System, Cleveland, Ohio, September 15, 1937.

Stomach and Intestine

RUPTURED stomach or intestines present urgent symptoms, and with aid of the x-ray air bubble, may be diagnosed early. The standardized treatment by repair and drainage will often be successful provided early diagnosis and favorable surroundings make timely exploration possible.

Bladder rupture is readily diagnosed and requires suture and adequate drainage.

Penetrating Wounds

PENETRATING wounds such as bullet, knife, explosion, chips of steel, or other foreign body, are routinely explored at the first safe moment, giving due consideration to surgical competence and operative requirements.

Immediately presenting hemorrhage should be first controlled, then obvious perforations of the viscus closed, followed by a routine examination of the intestine from pyloris to rectum, noting the mesentery as the bowel is gently glided through the examiner's hands. It is the undiscovered rent that seals many defeats; extensive resections should not be undertaken when shock or blood loss has been severe until a moderately safe rehabilitation has been obtained. Stomach perforations are seldom single. Posterior rents should be treated through an anterior wall incision. If the pancreas has been damaged, adequate drainage must be established.

General Discussion

THE surgeon recognizes that: (a) Uncontrollable bleeding is the most potent danger. (b) Shock cannot be overcome while bleeding continues, therefore, fatal delay may result from overtreating so-called shock before exploring. (c) Local anesthesia in the presence of severe shock may be wisely used, before general anesthesia is safe — spinal is definitely contraindicated in deep shock or low blood pressure. With suitable blood pressure, spinal anesthesia is ideal for exploration and repair.

In closing may I remind you of the serious responsibility of the physician and surgeon in the treatment of acute abdominal injuries. It is a serious responsibility to direct an exploration where a non-perforating injury has occurred; it is questionable courage to delay exploration in perforated wounds even though severe shock and hemorrhage are not evident. Upper abdominal wounds, such as was that of President McKinley, may show no marked pathology until a fatal trend has developed behind the scene. While a fair percent of perforated wounds are harmless, the general high mortality assuredly justifies the aphorism that all perforating wounds merit exploration when conditions for such are available. One competent to explore will not injure a harmless case, and routine exploration will often save a life.

The non-perforated severe abdominal trauma may easily merit the fear and respect of the doctor. Drs. Reilly and Dickinson have clearly established such injuries as major surgical problems, and keen discernment is an essential equipment of the medical adviser. Of prime import is the dictum that clinical proof of progressive hemorrhage leaves no alternative other than exploration as rapidly as conditions permit. Shock and hemorrhage are often merged, indistinguishable and interdependent. Shock can be treated while exploring to control its progenitor, hemorrhage. Procrastination is often rash judgment, when it is intended to be conservative. If laboratory and hospital facilities are available, the problem is simplified, but in the final analysis, the judgment of the level headed clinician must continue to conserve life in acute abdominal injuries.

Pro-Vitamin A Ointment

WILLIAM B. BAKER, B.S., M.S.,
and
HAROLD A. VONACHEN, B.S., M.D.,
Peoria, Illinois

THE efficacy of vitamin A activity in the local treatments of burns, wounds and ulcers is recognized by a number of investigators.

It is now proposed that a *plant* source of vitamin A activity, carotene (pro-vitamin A), may exert local beneficial effects as a stimulator of tissue granulation, and accordingly this plant source is recommended here instead of fish liver oils used heretofore.

Former Source of Vitamin A Activity

DURING the past number of years considerable work has been done by Seiffert,[1] Zuelzer[2], Loehr[4], Drummond[5], Green and Mellanby[6], Proto[7], and others in the treatment of burns and wounds with ointments of cod liver oil.

Loehr used a cod liver oil ointment on several thousand cases of new and old burns and other injuries with excellent results, and claims that an ointment of this type causes stimulation of epithelization and abundant granulation.

Many investigators confirm the findings of Loehr. In each case, the good results obtained are attributed directly to the vitamin A activity of the cod liver oil when incorporated into an ointment. It has been shown that vitamin A promotes the growth of explanted body tissues, and that the growth-promoting factor present beneficially affects the epithelial mesenchymal tissues.

Cramer, Green and Mellanby, and Drummond, showed that lack of vitamin A in the animal body diminished resistance to infection.

Steel[8] finds that cod liver oil as an external dressing for burns and ulcers is remarkable in stimulating the growth of granulation tissue.

Iost and Kochergin[9] find that, in their experience, a local application of cod liver oil is definitely beneficial in chronic ulcerations, burns, frost bites and recent trauma of soft tissues.

Recently Proto[7] investigated the actions of

vitamins A, C, and D on the healing time of wounds in animals. Using rabbits as the test animals, Proto applied these vitamins externally in wounds to some, administered the vitamins orally in others, and treated a third group of animals both by external application and oral administration of the vitamins. Still another group of animals was used as controls.

Proto found that when vitamins A and D are given by mouth, a slight amount of healing is promoted. However, when these two vitamins are *applied directly to the wound* healing is greatly accelerated.

Vitamin A was particularly effective.

Vitamin C caused no discernible change in the healing processes.

Proto's experiments are particularly important in that they clearly demonstrate that the healing action of vitamins A and D (especially of vitamin A) on wounds, is attributed to the effects upon the epidermal tissue itself, more so than to the action by way of oral administration.

Disadvantages of Fish Liver Oils

THE fish liver oils, especially from cod and halibut, contain abundant amounts of vitamin A. However, usage of these oils presents many disadvantages, some extremely difficult to overcome.

Among the disadvantages of the fish liver oils as a source of vitamin A activity for incorporation into ointments, probably the most important is the fact that these oils contain varying small amounts of free fatty acids, which are prone to decompose and become rancid. This is highly objectionable, chiefly because a rancid oil is most generally irritating to open wounds; further, the vitamin content of rancid oils is very apt to be partially destroyed.

It does not seem feasible to add an aromatic ingredient to fish liver oils in an attempt to mask their odors. Despite the addition of preservatives and perfumes, compounds made from fish oils usually emit a characteristic fish odor which is highly objectionable to the patient. The use of preservatives in an attempt to allay rancidity and decomposition is usually frowned upon, since preservatives often allegedly destroy, at least in part, the vitamin A.

Furthermore, it is never certain whether a preservative may or may not be harmful to the wound.

From a physical standpoint, the fish liver oils are not entirely suitable for incorporation into ointments. To obtain sufficient vitamin A activity, a comparatively large amount of the oils is required to be contained in the ointments. Consequently, the average cod liver oil preparations for external use are relatively thin pastes, and are too readily absorbed into wound dressings, therefore are not retained in actual contact with the wound in optimum amounts.

In view of the disadvantages of the fish liver oils, it would seem that a better source of vitamin A, or vitamin A activity, would be most welcome at the present time.

Pro-Vitamin A Locally

IT HAS been shown[7] that vitamin A activity is exerted to good advantage in the treatment of local wounds in animals, while oral administration only has a slight effect upon the skin. Therefore, the dominating influence of the liver in the vitamin A metabolism apparently does not greatly apply to the manifestations of the vitamin directly upon injured epidermal tissue.

This revelation not only sheds a new light upon the manner of function of vitamin A on epidermal tissue, but also reveals the possibility that the conversion of pro-vitamin A (i.e., carotene) into vitamin A by the liver may not be necessary in order to obtain the activity of vitamin A upon local wounds.

The biologic importance of carotene as the precursor of vitamin A is generally accepted. Pure crystalline carotene has been established as the international standard for vitamin A. The international unit for vitamin A adopted at the Second International Conference on Vitamin Standardization, 1934, is defined as the vitamin A activity of 0.6 microgram of beta carotene.

It follows, therefore, that pro-vitamin A may well exert a local action upon the skin similar to the action of vitamin A, or may have an action of its own, capable of stimulating epithelization.

Preparation of Pro-Vitamin A Ointment

WITH the object of avoiding the disagreeable odors and the danger of decomposition associated with ointments containing fish liver oils, an ointment incorporating beta carotene as the source of vitamin A activity was prepared for the purpose of ascertaining whether tissue growth-promoting properties similar to vitamin A could be expected.

The ointment was compounded so as to contain carotene (pro-vitamin A) equivalent to 2,000 units per gram of vitamin A activity, which is more than three times the vitamin A strength of cod liver oil, U.S.P. It is emphasized here that *no* fish liver oil of any kind was used in the ointment.

In choosing a suitable base for this ointment, petrolatum alone was judged to be unsatisfactory, since carotene is not absorbed into the body tissues when in this carrier. For this reason, cacao butter was used as the absorbent base, while sufficient petrolatum was added to maintain a suitable physical consistency.

Precautions were taken to insure a sterile product, by the employment of cacao butter and petrolatum that had been previously sterilized by heating at 100°C. (212°F.) for two hours. This base was then cooled to about 65°C. (149°F.) and the carotene dissolved therein. After incorporation of the carotene with the base, the resulting ointment was kept at an elevated temperature (approximately 50°C., 122°F.) so as to maintain the product at such a consistency that filtration through cotton flannel and gauze would be facilitated. Immediately after filtration the finished product was stored in sterile ointment tubes of block tin, to safeguard against possible loss of

vitamin activity through oxidation. Before being sterilized, these ointment tubes were cleansed thoroughly to remove all organic matter.

Since carotene itself, as extracted from plant sources, contains natural anti-oxidants, and because added preservatives are often reputed to be responsible for loss of vitamin A activity, it was deemed unnecessary and unwise to add any artificial preservative.

Further, added preservative agents might complicate the interpretation of subsequent clinical results.

Experimental

IN ORDER to observe the effects of the pro-vitamin A ointment on actual cases of burns and wounds on human subjects, the preparation was distributed to members of the medical profession for their clinical use. Burns, wounds (infected and non-infected), chronic ulcers, and certain other skin manifestations due chiefly to injuries, were to be treated with the ointment.

The mode of application and the frequency of redressing of the ointment to affected areas was left to the judgment of the individual physician.

RESULTS FROM THE USE OF PRO-VITAMIN A OINTMENT

Patient	Injury or Lesion				How soon seen by physician after having acquired the affection	Condition of affected area before beginning treatment	When treatment began	Re-dressings	Discharge	Remarks
	Type	Manner in which acquired	Size	Location						
1.	Second degree burn.	.....	Silver dollar.	Scalp.	One week.	Markedly infected.	May 20, 1935.	Four needed. May 22, 24, 27, 31, 1935.	June 4, 1935	Burn area completely healed.
2.	Second degree burn.	Welding spark.	2½ inches in diameter.	Dorsum of foot.	About one week.	Marked infection.	May 31, 1935.	Four times, after initial treatment.	June 18, 1935.	Almost complete healing of burn area.
3.	Abrasion, then deep ulcer.	.....	Half dollar.	Anterior tibial surface.	One week.	Much inflammation and ulceration.	June 3, 1935.	Two re-dressings. Allowed to remain five days after each re-dressing.	Seven days after last re-dressing.	Ulcer completely closed.
4.	Third and fourth degree burns.	.....	.....	Right shoulder, arm, forearm, hand, finger and thumb.	Seven months.	Gangrene developed, necessitating amputation of hand.	May, 1935.	Seven re-dressings needed.	Within one month.	Two small open areas, size of silver dollar, remaining at flexion crease of elbow.
5.	Second degree burn.	Distilling hot mash.	Face, neck, left arm.	.....	About 30 minutes	Bed-ridden. Beginning exfoliation; secondary infection; some toxemia exhibited.	March 3, 1935.	On March 5, 14, 16, 18, 21, 25, 27. Returned to work March 30, 1935.	April 22, 1935.	Discharged as cured. No residual thickening of ear cartilage. Slight fading areas at sight of burns. Cicatricial formation, but no extensive scar formation.
*6.	First and second degree burns.	Hot pitch.	.....	Eyes, nose, arm, left forearm.	About 30 minutes.	.....	September 11, 1935.	Thirteen applied.	At end of one and a half months.	No evident scar formation; complete healing of the multiple burn areas.
*7.	First and second degree burns.	Hot pitch.	.....	Entire right arm, chest, neck.	About 30 minutes.	.....	September 11, 1935.	Three applied.	September 23, 1935.	Complete healing of burned areas without scar formation.
*8.	First and second degree burns.	Hot pitch.	.....	Back of right shoulder, right hand.	About 30 minutes.	.....	September 11, 1935.	Three applied.	One week after beginning of treatment.	No evident scar or other residual pathology.
9.	First, second, and third degree burns. (*Received burns at same time.)	Contact with short circuit.	.....	Region of right shoulder downward to the lateral and flexor surfaces of the arm and forearm. Palmar surface index and fifth finger, entire right leg. Right, anterior tibial surface of each, 1.5 inches in diameter.	About 18 hours.	Required hospitalization.	September, 1935.	Daily for one week at hospital; then four day intervals over a period of one month.	After five weeks of treatment. Due to involvement of the flexor tendons, there was limitation of extension of the index and fifth finger.	Burned areas completely healed at time of discharge.
10.	First and second degree burns.	Steam.	Extensive.	Back and right arm; flexor and extensor surfaces of the arm.	Thirty minutes.	Required hospitalization.	August 1, 1935.	Three to four day intervals over a period of two weeks.	Two weeks after beginning of treatment.	No residual cicatricial formation at discharge.
11.	First degree burn.	Steam.	.....	Entire medial surface of right leg.	.....	.....	January 27, 1936.	.....	At end of one week.	No evident infection at site of burns at any time. Exfoliation that occurred was of dry type.
12.	Second and third degree burns.	Caustic soda.	.....	Face, right ear, right side of neck.	About 30 minutes.	Evident toxemia present during first week.	December 28, 1935.	At three to four day intervals.	February 20, 1936.	No residual pathology except in region of the right internal ear.
13.	Second degree burns.	Hot grease.	Hand-sized on anterior chest; size of silver dollar on wrist. Multiple quarter-sized areas on face.	Right hand, face, neck; anterior chest, flexor surface of right wrist.	Twelve hours.	.....	March 16, 1936.	First redressing two days later. April 22, another redressing.	April 25. 1936.	Evident sign of beginning epithelisation around edges noted at time of first redressing. Redressing on April 22 showed wounds of face almost completely healed.

The general rules of surgery were observed before the application of the medicament.

Contra-Indications

FOR obvious reasons, the ointment was contra-indicated in the treatment of ulcerated areas due to tubercular or syphilitic conditions, and for ulcers of malignant nature.

Tabulations

ACCOMPANYING are tabulations of results obtained by the use of the pro-vitamin A ointment, as reported by physicians to whom the preparation herein described has been distributed.

First observations of the tabulated results seem to show that the healing processes were stimulated and the usual healing time shortened considerably, in most cases, by the action of the ointment. This effect of acceleration of healing parallels the action reported by numerous investigators for vitamin A ointments in the treatment of burns.

No untoward effects of the ointment or of the large amount of resorbed pro-vitamin A were exhibited in any of the patients treated with the pro-vitamin A ointment.

RESULTS FROM THE USE OF PRO-VITAMIN A OINTMENT

Patient	Injury or Lesion			How soon seen by physician after having acquired the affection	Condition of affected area before beginning treatment	When treatment began	Re-dressings	Discharge	Remarks
	Type	Manner in which acquired	Size	Location					
14.	Second degree burns.	Hot water from car radiator.	.....	Flexor and extensor surfaces of left wrist.	One day.	.....	April 3, 1936.	Four in number: April 4, 12, 15, 18, 1936.	April 15, 1936.	Three punctuate unhealed regions only remained on dorsum of wrist. Later healed completely.
15.	.....	Laundry press.	.....	Involving middle phalanx, left first finger.	Four days.	Ulcerative area on dorsal surface.	April 20, 1936.	Two in number: April 22, 24, 1935.	.....	At time of second re-dressing, wound much cleaner, inflammation less around edges. Healing complete after the two redressings.
16.	.....	Ironer.	Half dollar.	Dorsum of the right wrist.	Two weeks.	Infected ulcerative area.	April 9, 1936.	Five in number.	.....	Re-dressing at end of four days showed beginning granulation at base of ulcerative area. One week later only a tiny ulcerated area remained. Three more re-dressings completely closed the denuded areas.
17.	Scar from burn.	Burn.	One inch square.	Forearm.	.....	Scar tissue present.	.....	.....	Within one month.	Almost healed in one month's treatment.
18.	First and second degree burn.	.....	From middle of thigh to foot. Involvement of about 10% body surface.	Right leg.	About 24 hours.	5% first degree burn; 5% second degree burn.	April, 1936.	Three in number; 48 hours apart.	Within 16 days.	Patient discharged as cured.
19.	Indolent ulcers.	Second ulcer from adhesive bandage-dressing.	One and one and a half inches in diameter.	Left leg.	One week.	Discharging pus. Had been treated with ultraviolet and dry dressings with no results.	April, 1936.	Three in number; 48 hours apart.	At end of last treatment.	Recovery uneventful; patient discharged as cured.
20.	Ulcer.	.....	.....	Anterior surface of left leg.	.....	Patient had been treated for three months with other medicaments with no results.	.....	.....	Two weeks after beginning of treatment.	Ulcer healed nicely after routine treatment with pro-vitamin A ointment.
21.	Diabetic ulcer.	.....	About three inches in diameter.	Leg.	.....	.....	February 10, 1936.	Three in number; Feb. 17, 25; March 6, 1936.	March 14, 1936	Ulcer cleared up.
22.	Frost-bite.	.....	One and a half inches on each heel.	Heels of both feet.	.....	Frost-bite appeared to penetrate to bone of each foot.	January 30, 1936.	Three in number; Feb. 4, 12, 20, 1936.	March 1, 1936.	Affected areas completely healed.
23.	Incision.	Stab wound.	.....	.....	.....	Hospitalized. Wound opened while patient was in hospital.	October 22, 1935.	.....	October 31, 1935.	Wound entirely healed.
24.	Ulcer.	.....	3 x 5 inches.	Leg.	.....	Deep wound; bone exposed; sloughing of tissue.	December 27, 1935.	.....	April 30, 1936.	Wound showed much improvement after one week's treatment. Completely healed at time of discharge. Patient had been treated for condition 25 years previous without permanent results.
25.	Second degree burns.	Hot mash, explosion.	Extensive.	Entire face, upper portion of neck, forehead, and particularly the right ear.	.....	Severely swollen and edematous right ear.	March 2, 1936.	Every two days; later, on fourth days.	After two and a half weeks' treatment.	At time of discharge, no scarring remained, right ear returned to normal, few areas had pigmentation.

According to the results obtained on these observed cases, it would appear that the therapy is not limited for application to any one type of burn, but is equally as well suited for all degrees of burns. Ulcers, an abrasion, a frost-bite, and a stab wound also yielded to the treatment.

It is significant that infection did not occur in any one of these cases. Where infection was present at the beginning of treatment, the pro-vitamin A ointment appeared to remove it. This would indicate that the ointment is infection-resisting, another action which simulates the effects reported by many workers on cod liver oil ointments.

The cases treated were not controlled by comparison with untreated, affected areas; the reason being that physicians were unwilling to allow their patients to do without benefit of treatment on a portion of the affected area, while allowing another portion to receive the benefits of treatment with medicaments. However, several of the physicians obtained very gratifying results from the use of the pro-vitamin A ointment, *after* having used other treatments without success.

It is especially noteworthy that in Cases 4, 19, 20 the affected areas had been previously treated by other methods without success, before the pro-vitamin A treatment was instituted.

In Case 4, during the treatment by accepted methods, there was some closure of the burned area but owing to repeated infections the denuded area would not completely close nor could it be brought into shape for Tiersch grafting. Repeated attempts at Dakinization of the involved area would allow marginal healing for a time, then the infection would again gain full sway. Following a treatment for two or three days with Dakin's solution, an area that extended from the shoulder to just below the flexion crease of the elbow on the flexor surface and which was approximately three to four inches in width, was treated by an application of the pro-vitamin A ointment and the dressing was allowed to remain for one week. Approximately six to seven re-dressings were applied, and in about 30 days these areas were completely healed.

In Case 19, the physician had treated the affected area, an indolent ulcer on the leg of a 10-year old child, with ultraviolet rays and dry dressings, with poor results. As a result of using adhesive tape to secure the dressings, another ulcer appeared close to the first-mentioned ulcer. Treatment with the pro-vitamin A ointment was instituted on both ulcers. The dressings were left on for 48 hours at a time. After the third change of dressings the areas were completely healed and the patient discharged as cured. In Case 20, the patient was treated over a period of three months with other remedies, with not satisfactory results. The pro-vitamin A ointment was then used and the ulcer healed nicely in about two weeks.

Summary

IN VIEW of the disadvantages of the fish liver oils for external use, it would seem that a better source of vitamin A, or vitamin A activity, would be very welcome at the present time.

From the recent work of investigators on vitamin A for external use, it would appear that the dominating influence of the liver in vitamin A metabolism does not greatly apply to the manifestations of this vitamin directly upon injured epidermal tissue.

The conversion of pro-vitamin A (i.e., carotene) into vitamin A by the liver may not be necessary in order to obtain the vitamin A activity upon local wounds. Pro-vitamin A may exert a local action upon the skin similar to the action of vitamin A, or may have an action of its own, capable of stimulating epithelization.

With the object of avoiding the disagreeable odors and the danger of decomposition associated with ointments containing fish liver oils, an ointment incorporating beta carotene as the source of vitamin A activity was prepared for the purpose of ascertaining whether tissue growth-promoting properties similar to vitamin A could be expected.

Pro-vitamin A ointment was distributed to members of the medical profession for their clinical use on human subjects, in the treatment of burns, wounds, ulcers, and the like.

The results reported by some of these physicians appear to indicate that pro-vitamin A ointment, containing 2,000 units per gram of vitamin A activity, in the form of carotene, stimulates the healing processes and shortens the healing time of burns, an effect paralleling the action reported by numerous investigators for vitamin A ointments in the treatment of burns.

The cases treated by these physicians were not controlled by comparison with untreated, affected areas. However, several of the physicians obtained very gratifying results from the use of pro-vitamin A ointment, *after* having used other means of treatment without success.

In these "uncontrolled" cases, the attending physicians nevertheless attributed the accelerated healing action obtained to the pro-vitamin A ointment used.

In the several cases (Nos. 4, 19, 20) where other treatment had been used without success before pro-vitamin A treatment was instituted, the attending physicians were unable to ascribe the healing actions to any other medicinal treatment, and believe the results obtained were due to the pro-vitamin A ointment.

Conclusions

IN VIEW of the above findings pro-vitamin A ointment, because of its vitamin A activity, should receive more attention for its possibilities as a stimulator of granulation and epithelization in the local treatment of burns, wounds, ulcers, and the like.

2. Pro-vitamin A ointment, containing carotene equivalent to 2,000 units per gram of vitamin A activity, is recommended in the local treatment of burns, wounds, and ulcers.

3. It is emphasized that *no* fish liver oils (i e., cod liver, etc.) are used in pro-vitamin A ointment.

4. Pro-vitamin A ointment is contra-indicated in the treatment of ulcerated areas due to tubercular or syphilitic conditions, and for ulcers of malignant nature.

5. Pro-vitamin A ointment containing carotene to the extent of 2,000 units per gram of vitamin A activity is non-toxic. No untoward effects of the ointment of the resorbed pro-vitamin A were exhibited in any of the patients treated.

6. With the realization that more experimental work is needed to further substantiate the value of pro-vitamin A in the local treatment of burns, etc., one of us (Vonachen) is at present engaged in assembling much clinical data and experimental evidence of the "controlled" type; this extensive work will be published at a later date.

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New Books

ATLAS OF HEMATOLOGY, written by EDWIN E. OSGOOD, M.A., M.D., Assistant Professor of Medicine, and Head of the Division of Experimental Medicine, University of Oregon Medical School, Portland, and CLARICE M. ASHWORTH, Medical Illustrator, University of Oregon Medical School, Portland; published by J. W. Stacey, Inc., 236 Flood Building, San Francisco, California.

Review by

WM. D. MCNALLY, A.B., M.D.

THE authors have presented a book of 255 pages, 208 of which are dedicated to the text, the remainder being allotted to references and an index. The Atlas was primarily written to fill the demand for a book for the clinician, the student, and the technician rather than for the experienced hematologist.

The authors' aim is to show the physician and the medical student how to plan and interpret the examination, and the technician how to perform the laboratory phase of it. The symptoms and signs are included as aids to diagnosis and guides to planning the hematological examination and the principles of prognosis and therapy are outlined to show the practical application of the hematological study. Tables of cell identification are given to aid in recognizing a cell under the microscope, even though such a cell has not been seen by the observer before. There are also tables of differential diagnosis to assist the physician in arriving at the most probable diagnosis in the least time. The illustrations have been reproduced to an exact scale corresponding to the magnification of 2,500, unless otherwise stated. This book differs from others of the same type, in that major stress is placed upon morphology of individual cells, although microscopic fields are given. The authors have appended references chosen with the objective of familiarizing the reader with names of those who are doing research in this field and who have contributed the most recent and important articles.

The table of contents consists of 17 pages with interpretation of both laboratory and hematological methods which the authors have found best in their work as teachers in the University of Oregon Medical School. There are 22 pages giving normal hematological standards, nomenclature, and differential diagnosis of various diseases by blood picture. The illustrations of the various types of cells are excellent and very clear. Altogether this is an excellent book for use in colleges, and in laboratory diagnosis for the clinician and the technician.

SHORT WAVE DIATHERMY. By Tibor de Cholnoky, M.D., Associate in Surgery, New York Post-Graduate Medical School, Columbia University. Cloth; price $4; pp. 310, 38 illustrations. Columbia University Press, 1937.

Review by

A. R. HOLLENDER, M.D.

THE advent of short wave diathermy as a therapeutic agent has revolutionized the utilization of heat for a large variety of acute and chronic diseases. It is only within recent years that physicians in this country have come to realize the possibilities of short waves. This in spite of the fact that this measure has been extensively employed in European clinics. Although considerable experimental work is being conducted, one cannot yet claim conclusive results from the clinical application of short wave diathermy, its scope, indication, and limitations requiring much more intensive study. In many respects, however, its superiority over conventional diathermy is acknowledged. The fact that it lends itself to application without hazard in suitable acute conditions is a far reaching advantage. In this volume the author has covered the subject in a systematic manner. He divides his considerations into six parts, introducing them with a historical outline, continuing to the physical and experimental aspects and then finally to the technic and clinical applications. In the latter section diseases of the different systems of the body are carefully discused insofar as short wave diathermy is concerned. While this work is comprehensive, certain views of the author cannot be accepted as final. They merely represent opinions based on the present state of development of this newer therapeutic procedure. Over-enthusiasm is to be deplored and is cautioned against by the author. The hope is expressed that the book will be of service to the profession as a guide to the application of short wave diathermy; and that it will also serve as a stimulus to further study.

Industrial Hygiene Sessions

— Report of the Meetings of the Industrial Hygiene Section of the Sixty-Sixth Annual Meeting of the American Public Health Association, New York City, October 5-8 1937 —

THE Industrial Hygiene Section meetings of the Sixty-sixth Annual Meeting of the American Public Health Association had the following programs on the days mentioned:

TUESDAY, OCTOBER 5, 1937—SYMPOSIUM ON HEAVY METALS: "Precision Methods for the Evaluation of the Toxic Metals," by LAWRENCE T. FAIRHALL, PH.D.

"Mercury Poisoning from the Public Health Viewpoint," by PAUL A. NEAL, M.D.

"Lead Absorption, Lead Excretion and Lead Poisoning," by ROBERT A. KEHOE, M.D.

"Personal Protective Devices for Preventing Exposure to Heavy Metal Dusts and Fumes," by WILLIAM P. YANT.

TUESDAY, OCTOBER 5—LUNCHEON SESSION:

Informal discussion and committee reports.

WEDNESDAY, OCTOBER 6—JOINT MEETING of Industrial Hygiene Section with Public Health Nurses and National Society for the Prevention of Blindness.

Presiding: LEVERETT D. BRISTOL, M.D., DR.P.H., Chairman, Industrial Hygiene Section.

SYMPOSIUM ON SYPHILIS CONTROL IN INDUSTRY, AND INDUSTRIAL DERMATOSES:

"Syphilis Control in Industry," by R. R. SAYERS, M.D.

"The Role of the Public Health Nurse in Syphilis Control," by GLADYS CRAIN, R.N.

"The Diagnosis of Industrial Skin Diseases," by LOUIS SCHWARTZ, M.D.

"The Role of Allergy in Industrial Dermatoses," by MARION B. SULZBERGER, M.D.

"Syphilis of the Eye as a Factor in Industry," by PARK LEWIS, M.D.

THURSDAY, OCTOBER 7:

Address of the Chairman: "Vaccines Against the Common Cold—Are They of Value in the Industrial Health Program?" by LEVERETT D. BRISTOL, M.D., DR.P.H.

"The Lung Findings in Foundry Workers—A Four-Year Survey," by O. A. SANDER, M.D.

"Development of an Industrial Hygiene Program in a State Health Department," by HERMAN F. EASOM, M.D., and M. F. TRICE.

"Diagnosing and Curing the Accident Habit," CHARLES S. SLOCOMBE.

Discussion: H. W. HEINRICH.

"Four Years' Experience with the Industrial Hygiene Appraisal Form," by E. L. SIMMONDS and E. R. DEJON.

Tuesday Morning Session

DR. LAWRENCE T. FAIRHALL, speaking on the subject "Precision Methods for the Evaluation of the Toxic Metals," felt that there was a certain routine for sampling methods and analyses, and that the results were no better than the physical data—furthermore, that better work was necessary. The groundwork is analytical, and validity is essential. Methods are constantly changing to others which are more rapid and more accurate. The conditions in industry, however, are changed in that we no longer have such massive exposures as previously experienced, thus rendering analytical procedures more difficult. As an example of this, we can mention lead exposures and poisonings which have diminished in frequency. This situation presents the problem of working with very small amounts of poisonous substances in large amounts of organic material. The operation of ashing is particularly difficult and most important for accurate analyses—we find that there are great variations in losses at different temperatures and in various types of substances, such, for example, as different lead salts. There has also been some difficulty in ashing various organs and selecting an oxidizing agent which was acceptable—the oxidizing agent of choice finally was decided as nitric acid. Benzene—hexacarboxylic acid is formed by tissue in the presence of nitric acid, also with the production of carbon dioxide. This compound is stable. In the use of the diphenyl test for color reactions, such reactions may be noted in the presence of other metals than lead—both zinc and tin may interfere, in the presence of organic material samples. No single method is as valuable as the spectrographic test at the present time, but it offers considerable difficulty from a practical point of view. Quantitative interpretation is really the problem. The time taken for the volatilization of the sample is a factor, and variation in quantitatvie results by the introduction of different media is also a problem. However, the spectroscopic method can become a reliable one. In conclusion, precision methods are justified for future accurate work in industrial hygiene studies.

DR. PAUL A. NEAL, in speaking on "Mercury Poisoning from the Public Health Viewpoint," reviewed the history, stating that mercury was known as an industrial poison as far back as 1600 B.C., also being known in Egypt, Arabia and India. Mercury poisoning in gilders was described by Ramazzini. At present, mercury is used considerably in the manufacture of chemicals and scientific instruments, and in the refining of gold. The metal involves the exposure of many workers and is a public health problem of considerable magnitude. Several lantern slides and tabulations showed various types of exposure in different industries, such as mining; manufacturing of alloys, including amalgams; electric industry; manufacture of felt hats; dentistry; laboratories; pharmaceuticals; vermicides, insecticides and fungicides;

explosives; photography, printing trades; battery manufacture; engraving and embossing; vapor boilers; jewelry; shooting galleries; taxidermy; mirrors; colors, and others. The toxicology of mercury involves dust, vapors, and absorption through the skin—the most important route of entrance is through inhalation. The symptomatology of chronic mercury poisoning was discussed, especial stress being laid on changes in the mouth and nervous system. In fur cutters, the exposure is mostly vapor, and the symptoms are mostly referable to the nervous system. The elimination of mercury occurs through the feces, urine, saliva, sweat and milk. At autopsy, mercury is found in the muscles, bones, kidney and liver. Storage, however, is mainly in the bones and has reference to the hydrogen ion concentrations. Nearly all important foods contain mercury. It has been stated that 0.4 milligrams of mercury inhaled daily may cause symptoms. It was found in the Public Health Service studies that 0.6 to 0.7 milligram were inhaled in this series. In the diagnosis of mercury poisoning, occupational history should contain all the occupations followed, with an estimate of the time. Particular attention should be given to pallor, mouth symptoms, tremor, differences in handwriting, the nervous symptoms, examination of 24-hour specimens of urine, spectroscopic examinations, and others. The finding of mercury in the urine is not a sign of mercurialism. It is hoped that a method of blood analysis will be worked out; the blood picture is usually negative. Prevention of inhalation of dust and vapors by the use of proper exhaust systems and the use of positive pressure masks is an important procedure in the prevention of mercury poisoning. Cases of mild type should be removed from exposure and methods of medical and engineering control should be properly exercised.

DR. ROBERT A. KEHOE spoke on "Lead Absorption, Lead Excretion and Lead Poisoning." The evalution of lead exposure and tests on feces, urine and blood are important procedures in diagnosis. Exposure may exist in unsuspected occupations, although control may be exerted where hazards are usually known. The physician who has no knowledge of plant conditions cannot be accurate as to the kind of exposure with which he is dealing. Exposures cannot be anticipated excepting by measurement or by physical response. There has been a threshold value established by studies on the measurement of exposures and the reactions to exposures. It is now established that non-industrial persons and others have a physiological level of excretion and tissue content. For instance, the following values have been worked out: 0.4 milligram per 100 cc. of blood—0.4 milligram per liter of urine—0.24 milligram per 24-hour specimen of feces—0.176 milligram per 24-hour ration of food. There is a close relationship between the fecal and food contents. In a comparison of the chemical methods, referring to the spectroscopic, the dithizone and carbazide methods, it was stated that the first two are the best. It has been stated that 0.25 milligram of lead per day is ingested on the average by the normal person, through the intake of food and drink; probably also there is a small amount inhaled. Most swallowed lead is quite likely unabsorbed, but there may be slight absorption. It is necessary to take account of normal variation in lead excretion, and in this respect accurate clinical observations are important. From various studies, it is apparent that the contamination of food and drink with lead is probably not increasing over previous amounts observed. Observations made in various lead trades show that there is a correlation between absorption and excretion. Lantern slide tabulations were shown of three different plant experiences, showing that in Plant A there was a hypothetical exposure with no poisoning—in Plant B there was an exposure with no poisoning—in Plant C there was exposure with poisoning; corresponding findings in the excretions and the blood agreed with the ranges of exposure in these plants.

WILLIAM P. YANT discussed "Personal Protective Devices for Preventing Exposure to Heavy Metal Dusts and Fumes." A summary of the various types of protective apparatus was given. Mention was made of supplied-air apparatus, air-purifying devices, activated charcoal for gases, filters for dust, and the possibility of fume filter units. Respirators are now available for chromic acid mist. The specificity of uses for hose and blower units, airline respirators, and abrasive blasting respirators was mentioned. No difficulty should be found in requiring employees to wear protective devices, where the matter is handled properly through gradual introduction and education. It should also be remembered that sanitation is most important.

The discussion of the papers in this session was participated in by Drs. Sayers, McCord, Hayhurst, Greenburg, Gray, and Smyth, and Messrs. Bloomfield and Bowditch. The need for improvement in methods was emphasized; it was stated that the spectroscope is important, but that the older methods will probably persist for some time. The importance of the correlation of exposure and clinical effects was brought out. It is probably important not to wait to establish toxic limits as judged by excretion. It was felt that the control of factory conditions in general throughout a large area was one of the next problems in industrial hygiene, and that tentative schedules of concentration were needed.

Tuesday Luncheon Session

THIS session included committee reports and informal remarks.

The Committee on Skin Irritants, Dr. Louis Schwartz, Chairman, made no report.

The Committee on Standards of Ventilation and Atmospheric Pollution, Dr. Emery R. Hayhurst, Chairman, has made no change in its program.

The Committee on Standard Methods for the Examination of Air was divided into several parts: subcommittee on Physical Procedures, Dr. C. P. Yaglou, Chairman, made no formal report; subcommittee on Chemical Procedures, Mr. Warren

A. Cook, Chairman, reported that data for a method book similar to the Water and Sewage Analysis Book of the A.P.H.A. are now being gathered and that these data have been passed on by various laboratories throughout the country; subcommittee on Dust Procedures, Mr. J. J. Bloomfield, Chairman, had no formal report; subcommittee on Bacterial Analysis Procedures, Mr. H. H. Wells, Chairman, also made no formal report.

The Committee on Standard Practices on Compensation, Dr. Henry H. Kessler, Chairman, made no formal report.

The Committee on Lead Poisoning, Dr. Robert A. Kehoe, Chairman, made no formal report.

The Committee on Pneumoconiosis, Dr. R. R. Sayers, Chairman, made no formal report.

The Committee on Industrial Anthrax, Dr. H. F. Smyth, Chairman, made no formal report.

The Committee on Volatile Solvents, Dr. H. F. Smyth, Chairman, had a report ready, but this was not read on account of its length. Discussion of the publication of this report ended by referring the matter to the Section Council for decision.

A feature of the luncheon session was the presence of Dr. Luigi Carozzi, of Geneva, Switzerland, who spoke on the functions and organization of the International Labour Office, and Dr. Kurt Wachtel, of Berlin, who made informal remarks on the relationship of general medicine to industrial hygiene. These guests were welcomed and introduced by Dr. R. R. Sayers.

Wednesday Session

THE Wednesday session was a joint meeting of the Industrial Hygiene Section, with the Section of Public Health Nurses, and also the National Society for the Prevention of Blindness, with Dr. Leverett D. Bristol, Chairman of the Industrial Hygiene Section, presiding. This meeting was a Symposium on Syphilis Control in Industry and Industrial Dermatoses.

DR. R. R. SAYERS, in commenting on "Syphilis Control in Industry," reviewed the development of our factual knowledge relative to syphilis, referring to the army experience which was later used in an attempt to apply the knowledge to the civil population. The establishment of state laboratories has been a considerable help in this program. It is believed that there are practically one million luetics in the United States and that about 15% of all blindness is caused by lues. In a recent survey by the U. S. Public Health Service of 80 industries, 15 make physical examinations which include serologic tests. The incidence of syphilis in a group of 110,000 men was approximately 4.8% according to the positive tests. At the present time it is believed that the following procedures should be inaugurated with reference to the venereal disease program: (1) serologic tests on all applicants for work; (2) periodic examinations where indicated; (3) an effective program of prevention and control; (4) the consideration of the possibility of using prophylaxis; (5) the establishment of the responsibility for the cost of treatment, considering the ability of employees to pay; and (6) that syphilis should be considered as any other communicable disease and that the ethical relationships of practitioner and patient should be maintained. Among the other subjects which are quite important in this program are those which pertain to the type of job in relationship to venereal diseases—the relative importance of the communicable stage—the time of returning to work after treatment. The excellent program of the Du Pont organization under the supervision of Dr. George Gehrmann was mentioned. It should not be forgotten that there is a possibility of overloading the state laboratories with serologic work. In summary, it is believed that serological tests for all industrial employees are a practical matter; that periodic examinations should be instituted where needed, and further, that treatment should be properly arranged and supervised.

GLADYS CRAIN discussed "The Role of the Public Health Nurse in Syphilis Control." There are approximately 20,000 public health nurses in the United States, which presents tremendous opportunity for the dissemination of information to the public. What were apparent difficulties melt before proper and sane methods of education. The province of the public health nurse lies in (1) education, assisting in case holding and general community education; (2) investigation in families; (3) arrangements for examinations; and (4) the guiding of suspected cases, assisting in the routing of patients—control of lues in pregnancy and consideration of congenital lues. There has been a great lag in the public health approach to this problem. Standards of procedure for follow-up programs were outlined. Experience with the program in various health departments was mentioned. In conclusion, it was stated that nurses in the schools and industries, as well as various groups, have a real part to play in the program of venereal disease prevention, particularly with respect to educational provisions in the study and evaluation of cases.

DR. LOUIS SCHWARTZ spoke on "The Diagnosis of Industrial Skin Diseases," stating that it was important to determine the industrial origin of skin disease, particularly because of compensation provisions and the responsibility for the payment of treatment. Because of the latter, there apparently has been a tendency to diagnose many lesions as industrial in origin, where they probably have had no distinct relationship to industrial processes. The diagnosis should be made on the history of distinct relationship to employment—knowledge by the physician of the substances to which the employee was exposed—site of the eruption (examination should be done only after complete disrobing)—the character of the lesions, according to the type of the irritant, realizing that the differential diagnosis is important with reference to exposure to substances outside of the occupation, where the patch test may be of value—one must also realize that no one sign or symptom is the basis for the diagnosis. Discussion of the

principles of the use of the patch test and its proper evaluation was also given. A number of lantern slides showing typical industrial lesions, as well as others, included cases of eruption in dye workers, paronychia, oil boils and folliculitis, eruption from exposure to chlorinated hydrocarbons, lime irritation, fungus infestation in a painter, cocobola wood eruption on the arm, trichlorethylene eruption, and an example of patching with cresol.

DR. MARION B. SULZBERGER presented the subject of "The Role of Allergy in Industrial Dermatoses." The incidence of skin diseases in industry amounts to about twice the incidence of all other types of disease, which makes this an important subject. There is a constant close association between dermatoses and syphilis. Allergy was simply defined as an unusually sensitive reaction from exposure to various substances. It is to be kept in mind that previous exposures can alter the reaction specifically, so that the subsequent reaction is most difficult to determine. We must consider not only the real skin irritants, but also substances which may produce hypersensitivity. Perhaps half the cases are due to sensitivity. Regarding a program in industry, we should find out the least irritating substances through patch tests on groups, thus establishing what is known as a sensitivity index; we should next determine what individuals are prone to react, through employment examinations, and also study the individual characteristics; it is also advisable to test with known allergens.

DR. PARK LEWIS, speaking on "Syphilis of the Eye as a Factor in Industry," commented on the necessity for good vision in industrial employment, illustrating by the example of the rapidity of transportation (1300 feet in 15 seconds) the real need of good vision in this type of occupation. Clinical picture of early lues of the central nervous system was reviewed. The wide variety of reactions and the insidiousness of lues was emphasized; it is fortunate perhaps that the early signs are shown in the eyes and also fortunate that a cure can be obtained. The industrial incidence of syphilis has been stated to be about 4.2%, varying from 12 to 35% in various groups. Stokes estimates that 12 to 35% of luetics show eye effects, hence the importance of this relationship. Reference was made also to government participation in the venereal disease program.

In the discussion, it was brought out that it is important to know not only the scientific aspects of industrial diseases, but also the compensation aspects; the importance of diagnosis in establishing the responsibility for treatment in skin diseases, and that the error in such diagnoses is not always made by the general practitioner. Responsibility for treatment of venereal disease was especially mentioned. Dermatitis from dye exposure is rare and what there is, is quite likely allergic. In industrial dermatoses, it is important to set up criteria for establishing the occupational relationship, where the real problem is the occurrence of sudden susceptibility and the exclusion of non-occupational dermatoses. The discussion was participated in by DRS. CAROZZI, CRANCH, GOLDBERG, SCHWARTZ, SULZBERGER, and MR. LEWIS H. CARRIS.

Thursday Session

DR. O. A. SANDER gave "The Lung Findings in Factory Workers—A Four-Year Survey," illustrating his talk by a number of tabulations on lantern slides. This survey was made in 1932, and of the 15,000 workers involved, 10,000 were foundry employees. The study was based on physical examinations and x-ray films of the chest, using the x-ray classification as published in the U. S. Public Health Service Report of August 2, 1935. In a foundry group of 4,035, the incidence of normal lung findings was 71% and the incidence of silicosis was 7%. Lantern slides of a chest showing exaggerated markings without dust exposure occurred in the case of sinus infection—another lantern slide showed less exaggerated markings than the former, in a molder of 25 years' experience, whereas early nodulation occurred in a sand chipper having 32 years' experience. As to the incidence of tuberculosis, active cases were found in 19 instances in all the foundrymen surveyed, or an incidence of 470 per 100,000. In a group of 279 silicotics, 60% had demonstrable tuberculosis. In an analysis of 12 cases of new infection and 13 cases of reactivation, the observations were continued over a period of four years in a group of 1,982 foundrymen. The incidence of silicosis is highest in sand blasters and sand chippers and least in molders and coremakers. It is not believed that the carbon and the calcium content in the foundry dust is significant and the same belief applies to aluminum dust. Some of the conclusions reached in this study were to the effect that lung infection occurs before 40 in the majority of men—that usually there is no activity in a quiescent period. As to preventive measures, periodic examinations, with x-rays, and controlled dust source, together with pre-employment examinations, are believed to be the procedures of choice.

Discussion was participated in by DRS. GREENBURG, LANZA, PEDLEY, HAYHURST and SANDER.

MR. M. F. TRICE presented the subject "The Development of an Industrial Hygiene Program in a State Health Department," referring particularly to the experience of North Carolina. Beginning with a damage suit for asbestosis in 1924, the Act in this State was amended the next year to include occupational diseases as compensable injuries. Subsequently the Industrial Commission of the U. S. Public Health Service established the Division of Industrial Hygiene in the State Health Department, where in September, 1935, a physician and engineer were installed as the staff; later two more physicians were added and at the present time an additional engineer has been put on the staff. A preliminary survey showed that siliceous dust was the most frequent industrial hazard, other valuable data also being uncovered in the preliminary survey. The industrial commission was vested with the power to make a

list of the industries where certain hazards exist and also to conduct studies. Among these studies, there have been surveys conducted in foundries, in mines, and also in a newspaper plant. Examinations have also been conducted on 4,500 workers. Approximately 10% of workers show some pathology of the lungs, whereas 3% show cardiovascular changes. There was a high incidence of decayed teeth and diseased gums. It is believed that good housekeeping is an important item and should be stressed by an educational program. Every effort is made to keep the worker on the job. Copies of reports are sent to the industrial commission, the compensation bureau, and the employer.

The discussion was participated in by DRS. MCCORD, HAYHURST, and EASOM, the latter stating that active tuberculosis was cause for rejection—emphasis was also placed upon the importance of experience with silicate dust exposure. Discussion was concluded by MESSRS. BOWDITCH and COOK.

THE Chairman's address on "Vaccines Against the Common Cold—Are They of Value in the Industrial Health Program?" was given by DR. LEVERETT D. BRISTOL. The basis for this paper came from studies being made throughout the Bell System among employees over several years' time. Standard vaccines were used on a voluntary basis for employees by making arrangements with the family physician, covering altogether six companies with 20,000 employees in periods varying from five to 20 years. The reports as to the efficacy of this method of treatment vary from a wide variety of conclusions—in one plant 85% showing some immunity, in another 50% to 80% improved, cases not so severe, lessened severity but not incidence—to a statement of relief to some degree. Of course it must be acknowledged that the reporting is not scientific and accurate because it is handled by persons untrained and also possibly the memory of severe attacks is more vivid than the occurrence of frequent attacks. It is possible that the treatment exerts an indirect check on the pathogenic organism. Apparently the so-called "cold prone" people approximate 25% in any group. In summary, there is little or no evidence relative to the reduction of the incidence of colds, although there may be some value in the administration of vaccines to large groups. Certainly no one procedure should be relied upon, but there should be a broad program of prevention and control for the common cold.

In the discussion, emphasis was placed on psychological factors present in using distilled water on one group and vaccine on another to produce 77% benefit in both groups, by MR. LAKE. DR. ROSENOW commented particularly on the bacterial phases of the use of vaccines and emphasized particularly the role of secondary invaders and also the use of autogenous vaccines rather than stock vaccines.

CHARLES S. SLOCOMBE spoke on "Diagnosing and Curing the Accident Habit," giving figures in a plant of 6,600 which had 900 repeaters, of which one man had 37 accidents. In one instance, 48 men had 67 lost-time accidents; in other words, 1% of the men had 10% of the accidents. In an analysis of factors behind such experiences, it has been found that the men have been untrained, that they have been assigned to improper work, or that they have been in poor physical condition. It is vital to get the real story of accident occurrence and to secure the cooperation of the physician, the engineer, and foreman to cut down the incidence of non-lost-time accidents by the changing of habits.

The discussion was participated in by MR. H. W. HEINRICH and MR. GRAHAM COLE, emphasizing the necessity of finding the causes and controlling them and emphasizing also the lack of proper supervision as the cause of accidents.

MR. E. R. DEJON gave the final paper in the Industrial Hygiene Sessions on "Four Years' Experience with the Industrial Hygiene Appraisal Form," as reflected in the experience of the New England Telephone Company in the State of Connecticut. This experience involved 4,800 people in 105 locations, 60% of the persons being females. The program was a very complex one. There were periodic examinations, with disability benefits and death benefits provided for since 1913. A sound program was provided for through a planned service. The use of the appraisal form was started in 1932 and now there is an annual appraisal made. In following out this program, emphasis has been placed on the prevention of sickness, the reduction of the sickness period, and the coordination of other groups with the medical office. The necessity for using an appraisal form has arisen because of the desire to have an adequate record system, to use the principle of sickness prevention as the basis for such a system, to provide stimulation for the supervisory staff, and as an added incentive toward the use of sufficient funds to carry out health supervision. The conclusions reached were that the appraisal plan is recommended to those executives who wish to have a sound program of health supervision—that the appraisal plan is a splendid guide showing progress made—that it is a stimulation to better effort—and that it is actually productive of a happier and healthier personnel.

Industrial Dermatoses

MARION B. SULZBERGER, M.D.,
Assistant Professor of Clinical Dermatology and Syphilology, New York Post-Graduate Medical School, Columbia University

YOU have just heard the preceding speakers, and have surely noted the emphasis they placed upon the future in the control of industrial diseases.* You have heard them stress that their hopes lie in the direction of prophylaxis, that is, of the prevention of industrial diseases be-

* Based on Addresses before the Eighth Annual Convention of the Greater New York Safety Council, New York City, April 14, 1937; and before Northwestern University Symposium on Industrial Diseases, Chicago, September 27, 1937.

fore they occur. This is the way of the future—not only because of the humanitarian wish to prevent illness, suffering and premature death, but also because of the cold-blooded but weighty reason that it will in the future undoubtedly prove less costly to prevent industrial disease than it does now to pay for its treatment and disability.

In the previous addresses, and in general in discussions on industrial disease, the main topics are the actual causal hazards. However, the study of industrial dermatitis has most clearly shown that this is but one aspect of the problem of prevention. Prevention of industrial dermatitis must be approached from two major viewpoints; and the attack must be launched on two fronts. For in the endeavor to reduce the incidence of industrial dermatitis, it is apparent that not only the type of hazards must be known, but also the individual worker's peculiar susceptibility to sustain damage from specific hazards. It is not to be gainsaid that human skins vary tremendously in their power of resisting various types of onslaughts, and that many workers will continue with impunity in occupational exposures which produce dermatitis in their fellows.

This individual difference in the power to resist —or to put it conversely, this individual variation in sensitivity — is not confined to the skin but doubtless exists to varying degrees in all organs. Therefore, this consideration acquires general importance, far transcending that of industrial dermatitis. The factor of individual variations in susceptibility is an important concept in the study of almost all diseases. It is, therefore, a dominant and decisive factor not only in the skin diseases of industry, but also in many other industrial diseases. In pneumoconioses, for example, it is today apparent that of many workers similarly and apparently equally exposed, only a few may succumb to silicosis.

But nowhere is the necessary consideration of individual predisposition to disease—of individual sensitivity or lack of resistance to industrial hazards—as clearly manifest as in industrial dermatitis of eczematous type. And it is perhaps for this very reason that dermatologists have been the first to attempt to devise methods for studying the different susceptibilities of different individuals.

We have attempted to achieve a means of finding out beforehand not only which industrial substances are most likely to produce dermatitis, but also to determine before exposure just which workers will prove to be most susceptible to dermatitis from certain causes. It seems to me that this fact is of the most vital general interest and for this reason I shall dilate on this point.

The patch test has proved its usefulness in the search for possible causes of dermatitis in workers—provided it be properly applied, provided it be properly read, provided the reaction be properly evaluated and provided the test be used with the full knowledge of its limitations and provided it be called upon only when and where indicated—with these provisos, the patch test has proved the most valuable means of determining the causal agent in eczematous dermatitis based upon individual susceptibility or sensitivity.

I shall not here discuss the value of the patch test in the problems of running down the causes of individual cases of eczematous industrial dermatitis. I believe that enough has been said and written on this aspect of the test, and that it has here fully proved its value since its dermatologic introduction in this country in 1928.*

The future great usefulness of the patch test lies, I believe, in its employment for preventing or reducing the incidence of industrial dermatitis. This must be accomplished in two ways: (1) by discovering and eliminating from industry those substances which are most likely to produce eczematous dermatitis, in so far as these substances are not absolutely essential to the industrial process; moreover, in the event of certain classes of substances being indispensable, by enabling a selection of those of each class which are least likely to produce dermatitis; and (2) by weeding out from those industries having known and unavoidable hazards of dermatitis those individual workers whose skins are most likely to prove sensitive to the respective industrial hazards.

I believe that proper use of the patch test will prove valuable in both of these directions. The test will surely never solve all the problems of industrial dermatitis, nor will it eradicate this form of industrial disease. But it is my opinion that the "prophylactic patch test" will eventually enable industry to eliminate many of the most vicious offenders among the substances now causing dermatitis; and that it will permit the selection of workers least likely to succumb to dermatitis. I further firmly believe that this is one of the best remedies for the present unbelievably expensive, crude and cruel methods which require years of bitter experience before one eventually realizes which substances will prove harmful, before one finds out which workers will be sensitive and susceptible to certain hazards, and are, therefore, unsuited for specific jobs.

DR. ROSENBERG, JR., and I recently discussed the patch test method for determining beforehand the relative probability that a given substance will produce sensitization dermatitis, and the method of determining beforehand the relative probability that a certain individual will eventually become sensitized if exposed.**

I should like to call the figure denoting the relative probability that a substance will sensitize, the "Sensitizing Index" of that substance; and the figure denoting the relative probability that a certain person will become sensitized, the "Sensitization Index" of that person.

In industry then our object will be to eliminate as far as possible those substances shown to have

* For those interested in my views on this side of the question, I refer to previous publications, for example *Arch. Dermat. & Syph.* 23; 519, 1931; *Am. J. Surg.*, new series, 30, 531-540 & 550, 1935; *New York State J. Med.* 36, September 15, 1936; *Am. Med.*, new series, 28, 4-7 and 16-22, Special Section, June, 1933.

** *Arch. Dermat. & Syph.* 35; 433, 1937.

high "Sensitizing Indices"; and to eliminate from occupations hazarded by known sensitizing exposures all workers who are shown to have high "Sensitization Indices."

I shall be brief in explaining the methods for scientifically determining the "Sensitizing Index" of a substance and for determining the "Sensitization Index" of a worker. If one "patch-tests" a sufficient number of individuals with dermatitis simultaneously with a certain number of different eczema-producing substances, one will find that the total number of reactions produced by the different substances is usually different. For example, substance "A" may produce ten reactions while substance "B" produces only five reactions per 100 persons tested. It may then be stated that in this investigation substance "A" has a "Sensitization Index" twice as great as that of substance "B." It is logical to assume that, all other conditions being equal, substance "A" is twice as dangerous a skin hazard as substance "B." And in my experience such a ratio is usually borne out in practice.

In this manner an unlimited number of substances may be ranged in the order of their relative likelihood to sensitize, of their "Sensitizing Indices," and thereby in the order of their relative likelihood to produce sensitization dermatitis.*

In a somewhat similar manner, workers to be employed in occupations hazarded by substances notoriously capable of producing dermatitis may be patch-tested by the actual substances of the industry and also by a series of other substances known to be common causes of eczematous sensitization. Those individuals having the highest number of positive reactions have the highest "Sensitization Indices" and are, therefore, least suited for the hazardous job.

IT IS always to be borne in mind that not only those reacting to the actual substances to be encountered in the prospective employment, but also those reacting only to a high percentage of the other eczematogenous substances are by no means ideal employees. For if they have previously become sensitized to numerous other agents, they are marked candidates for dermatitis, and stand a good chance of becoming sensitized to the substances of the new occupation.

While the above is one important method for weeding out beforehand those prone to be victims of dermatitis, it applies particularly to sensitization dermatitis and is by no means the only method. It is well known that skins which are too dry or too greasy, skins too damp with perspiration, skins which are thickened and cracked, and skins which have been infected with fungi, ringworm and other germs are all predisposed to occupational contact dermatitis. It is also stated that fair-skinned individuals are more susceptible than the dark-skinned, and whites more susceptible than negroes.

But there are still other factors to be considered. It is, for example, today highly probable that "acid skins" will better resist alkaline hazards, and "alkaline skins" be less sensitive to acid substances. It also seems possible that greasy skins perhaps defend themselves more successfully against substances soluble only in oils.

In closing I can perhaps best repeat what Wise and I have said five years ago, ". . . the present method of approach in occupational diseases leaves much to be desired. The system is characterized today by inaccuracy and wastefulness. . . . we must develop facilities for the training of physicians who will be specialists in industrial diseases; and we must strive for a close cooperation between such experts and the industrialists and the legislative and judiciary bodies. There is no doubt that the training of such specialists can best be accomplished in clinics and hospitals primarily devoted to the diagnosis, treatment, prophylaxis and study of occupational disease.

"The dermatologic division of such an institute would not only accomplish this end in the case of skin diseases, but would save industry, labor, insurance companies and the community large sums of money. It is our opinion that the savings thus effected would probably rapidly amortize the cost of such an organization.

"It would be the function of such a dermatological department to train specialists in the field of industrial dermatoses; to study the individual cases, with the object of determining whether they be of industrial origin; to make every effort to ascertain, through the methods we have outlined, the etiological agents; to provide adequate facilities for the treatment of industrial skin diseases and thus eliminate the factors which now tend to retard the cures; to aid prophylaxis, through the weeding-out of those unsuited to certain occupations; and to advise industry as to which substances offer the greatest hazard by being the most likely to cause eczematogenous sensitization.

"It is obvious that such an institute should include a research department, where the scientific study of these diseases may be pursued; and where, more specifically, the question of sensitization and its causes may be investigated with the facilities, time and attention which it deserves."

I believe that dermatologic knowledge has now so far advanced that it offers a rational and scientific method for accomplishing a material reduction in the incidence of occupational dermatitis. This can only be accomplished, however, through the establishment of dermatologic institutes such as I have just described. When the Chairman introduced me, he said that I was to speak on the most common of all industrial diseases; this was an understatement. For industrial dermatoses are not only the most common but also are actually more numerous than the total of all other industrial diseases. According to conservative es-

* In the case of new substances or substances not generally encountered in every-day life, it will be necessary experimentally to sensitize human beings or animals in order to establish true sensitizing indices. This type of experiment is much more difficult, more complicated and costly than the simple patch testing, and I cannot describe the details here (See SULZBERGER and SIMON, *J. Allergy*, 6; 39, 1934).

timates, industrial skin disease represents between 50% and 85% of all industrial disease. In view of this fact, the speedy inauguration of an institute of occupational dermatoses can be urged not only on medical and scientific grounds, not only on sociologic and humanitarian grounds, but also on grounds of dollars and cents.

Three Interesting Fracture Cases

EDWARD T. NEWELL, B.S., M.D., F.A.C.S.,
Chattanooga, Tennessee

IN PRESENTING these three fracture cases, I hope to present a plan of approach in each case that is simple, effective, and to a great extent original.*

I have on previous occasions, referred to treatment of fracture of the clavicle by a specially modified Velpeau's dressing, made of silence cloth with the leverage applied in definite planes to correct the usual deformity of such fractures.

I have also referred to our home-made hinged airplane splints with turnbuckle traction at the elbow, and sometimes at the wrist, to be used in fractures of the proximal and middle thirds of the humerus, and in multiple fractures of the humerus complicated by fractures of both bones of the forearm.

In a paper before the Southeastern Surgical Association, and more recently in an address before the East Tennessee Medical Association, I have described our method of obtaining hyperextension in fractures and dislocations of the lower dorsal and lumbar vertebrae.

The histories of the cases to be reported with the x-ray films, taken before and after treatment was instituted, together with photographs (before and after) will explain the objective to be accomplished, and the modus operandi more clearly and in less time than I could recount to you.

Therefore, I report as follows:

CASE 1: Master Willie G., Bridgeport, Alabama, white male, aged 5.

The previous history of this case was that he came to me April 29, 1934, suffering from acute osteomyelitis of the lower third of the left femur. He was operated upon and after several months of dakinization apparently was cured. He returned in February, 1937, with a return of the trouble. He was operated upon under general anesthesia and a sequestia was removed.

On May 1, 1937, this patient returned with a swelling in his left shoulder, in the region of the clavicle. His father stated that he had painted it with a tincture of iodine, but gave no history of an injury. The diagnosis of osteomyelitis of the clavicle was considered and x-rays made to determine the seat of the trouble. X-ray showed fracture of the outer third of the left clavicle with slight angulation. His father then recalled a slight fall his son had recently but he did not think at the time that it had caused him any trouble, the patient being more or less confined to quarters on account of the osteomyelitis in his leg.

The patient was immediately placed in a Newell clavicle splint without any form of anesthesia. His left shoulder, which was shortened on account of the fracture of the clavicle, is of normal length following the application of the clavicle support.

The apparatus consists of three parts: A pad in the axilla strapped with adhesive to the side of the chest to produce extension of the shoulder when the upper arm is brought forward and to the side of the chest. A band of silence cloth, encircling the upper arm, strapped across the back of the patient with adhesive, fixes the proximal end of the humerus, for *leverage*, to be later applied, by a band of silence cloth two and one-half to four inches wide. This band has an opening in the center of it to fit the point of the elbow. The band

Fig. 1
Lateral x-rays of spine. Compression fractures of the 11th and 12th thoracic vertebrae. (Case 2)

passes over the back and forward over the forearm to the unaffected shoulder and when tightened elevates the affected shoulder. The application of these three simple appliances carries the shoulder *up—out*—and *back*, the necessary trinidad lengthening the clavicle and correcting deformity. In over 10 years, I have used only the above support and have had good results in all cases.

CASE 2: O.D., white American, aged 21, Rising Fawn, Georgia.

The patient was brought to the Sanitarium in an ambulance suffering from compression fractures of the eleventh and twelfth thoracic vertebrae also fracture of the sternum—no paralysis was present.

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* Presented at the Annual Meeting of the Association of Surgeons of the Southern Railway, Jacksonville, Florida, June, 1937.

The patient states that while loading a truck with timber a "log got away from us" hit him in the chest knocked him down and rolled over him. The patient had an enormous hematoma over the lower dorsal and the upper lumbar regions with abrasion of the skin. The hematoma was 4 inches wide, 12 inches long and 2.5 inches deep.

Fig. 2
Photograph of hyperextension of spine, by simply placing sand bag under fractured area. (Case 2)

It was out of the question, at this time, to consider placing this patient in the classical hyperextension position for the treatment of his fractured spine and fractured sternum. For a week he was permitted to lie upon his sides with appropriate treatment, heat, dressings, etc., to the hematoma. At the end of a week he was encouraged to lie upon his back for an hour at a time, and by the end of two weeks he was lying all the time on his

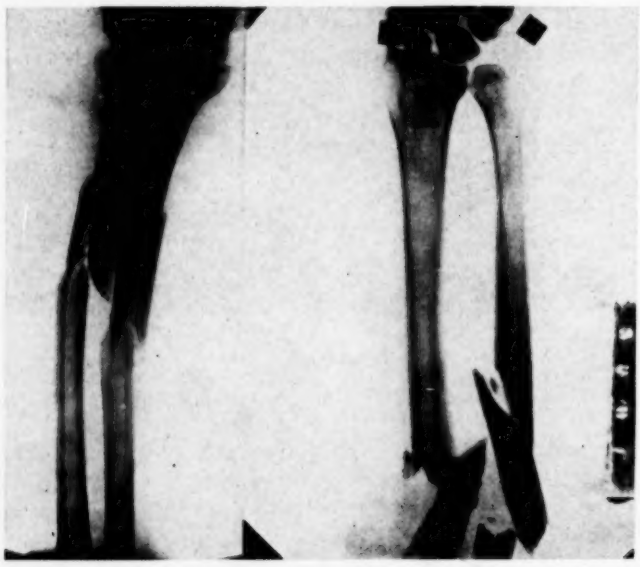

Fig. 3
Anteroposterior and lateral x-rays of left forearm. Oblique spiral comminuted fractures of the shafts of the radius and ulna. (Case 3)

back on a hard mattress. By the end of the third week he was using a pillow under the affected area. Before the end of the fourth week, two 12-inch boards were placed under the center of his springs, a 10-inch roll of cotton in a pillow case covered by an ordinary feather pillow was placed under his back in the fractured area, and he was made to lie on this for two weeks when he was placed in a plaster cast.

We have discarded the use of the Walton frame and instead use the above technique in all of our fractures of the spine in the dorso-lumbar region with a great deal more comfort and equally as much success. This patient is up walking around and left the hospital last Thursday.

CASE 3: R. T., Valley Head, Alabama, white American, aged 31.

This patient walked into the Sanitarium April 7, 1937, stating that a truck side-swiped his car breaking his left arm and forearm. The arm had been put up in a temporary splint by his local physician. There was great swelling of the entire left arm with abrasions on arm, forearm, and shoulder. X-rays taken showed a transverse irregular comminuted fracture of the left radius and ulna about 10 cm. from the elbow joint with several large fragments fractured out and with lateral and anterior displacement of the distal

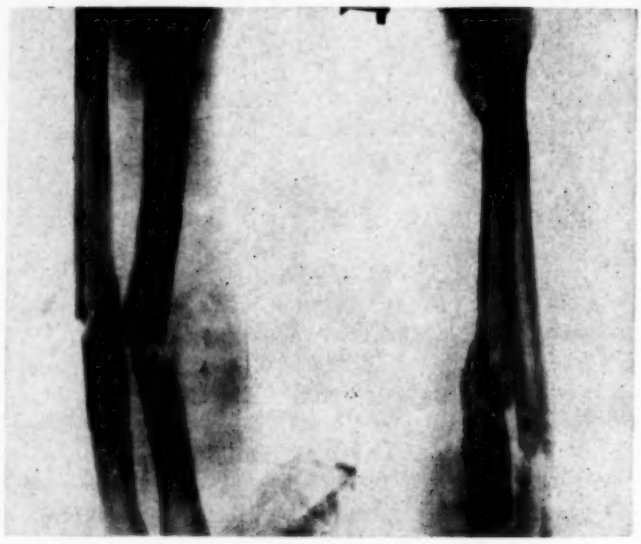

Fig. 4
Anteroposterior and lateral x-rays showing result after open operation and suturing with No. 4 40-day chromic catgut. (Case 3)

ends. There was also an oblique fracture of the left humerus 15 cm. above the elbow joint with some anterior and lateral displacement of the distal end. A large fragment of bone was fractured off from the lateral sides of the end of the bone.

Without anesthesia, the left arm was put up in a Murry-Jones splint with weight extension over a pulley on a side table. When the swelling and the soreness had subsided, he was placed in our hinged airplane splint with screw traction at the elbow. The forearm was simply bandaged to the splint without any attempt to approximate the fractures.

On May 4, 1937, under gas oxygen anesthesia open reduction was done on the ulna. Both ends of the loose fragment of bone were sutured with chromic catgut No. 4 to the proximal and distal fragments of the ulna; the wound closed without drainage. Thirteen days later open operation was

done on the radius. A loose fragment of bone which did not have periosteum attached was removed and suturing was done in similar manner to that of the ulna—no drainage. Both wounds healed by first intention. The patient's forearm was then encased in plaster and the patient dismissed with traction on the elbow and traction on the hand and wrist.

Fig. 5
Photograph of patient in home-made airplane splint, for oblique fractured humerus and comminuted fracture of both bones of forearm. (Case 3)

This last case was interesting, as it was a grave fracture, with severe trauma to the soft parts, multiple comminuted fractures all bones of arm and necessitated the application of the *closed* and the *open* method of treatment to secure a reasonably good result.

Conclusions: You will note that in the treatment of these three fractures we have used only the simplest of appliances—those that anyone can make and apply in his office or his sanitarium.

Surgeons' Meeting

—Abstracts of Papers Presented Before the Symposium on Industrial Medicine and Traumatic Surgery, 27th Clinical Congress, American College of Surgeons, Chicago, October 28, 1937—

As a part of the 27th Annual Clinical Congress of the American College of Surgeons in Chicago, Illinois, October 25 to 29, 1937, a symposium on industrial medicine and traumatic surgery, given on October 28 contained the following speakers and papers:

Frederick A. Besley, M.D., Waukegan, Illinois, Chairman of the Committee on Industrial Medicine and Traumatic Surgery, presiding:

"Recognition and Prevention of Lead Poisoning," Robert Arthur Kehoe, M.D., Cincinnati.

"Malunion in Fractures," Willis C. Campbell, M.D., Memphis, Tennessee.

"Injuries of the Chest and Abdomen," Edmund Butler, M.D., San Francisco.

"The Modern Concept of the Industrial Medical Problem," M. N. Newquist, M.D., Chicago.

"Reconstruction of Scalp and Ear by Tube-Graft Method," James A. Cahill, Jr. M.D., Washington, D. C.

"Physical Therapy in Relation to Industrial Surgery," Kristian G. Hansson, M.D., New York City.

Dr. Bowman C. Crowell opened the meeting for the chairman, Dr. Frederick A. Besley, who was absent temporarily.

Dr. ROBERT A. KEHOE, of Cincinnati, spoke on "Recognition and Prevention of Lead Poisoning." Lead is a very ubiquitous metal in industry, and we are concerned practically with a knowledge of industrial exposures. Our present knowledge properly applied will go far toward controlling industrial lead absorption and poisoning. A solution of our difficulties depends primarily on a recognition of injurious exposures. Considerable importance was attached to cleanliness and to ventilation and respiratory devices. Experience has shown that we can eliminate hazardous exposures through proper control measures. The real problem seems to be the magnitude and hygienic significance of ordinary exposures in industrial processes. There are three methods of recognition of industrial exposures: (1) medical supervision, involving a knowledge of plant conditions, proper physical examinations, thus checking the exposure; (2) determination of the lead content in the air of workrooms, through standard procedures; (3) studies of lead excretion in employees, producing the correlation between the excretions and the exposures, as has been shown in previous studies of industrial employees. In conclusion, industry needs good medical supervision, proper toxicological studies, and engineering practices to handle appropriately the problems relative to lead exposures, lead absorption, and lead poisoning.

Dr. WILLIS C. CAMPBELL, of Memphis, Tennessee, discussed the subject "Malunion in Fractures." The essayist had reviewed a series of 700 cases, of which 300 had been subject to surgical operation. The causes of malunion were stated briefly as: (1) improper reduction or failure to properly reduce fracture; (2) inadequate after-treatment, such as improper splinting, and lack of protection. Delayed union is of course very important. Treatment is mainly operative, but not all cases require operation, varying because of age, the site of the fracture, and various other considerations. The main types of operations are osteotomies, transplants of autogenous bone grafts, as illustrated in the slides which showed these types of operations around the ankle joints, the knee joints, the shaft of the femur, and in fractures about the elbow joints. In certain instances, it is necessary to remodel the joint, and also to do, in certain types of injury, an arthroplasty. In conclusion, the important points are: (1) correction of deformity with proper consideration of the

individual concerned; (2) protection over a sufficient period of time; (3) the avoidance of entrance into the joint unless arthroplasty is necessary; and (4) elongation if necessary, which can be done by half-inch autogenous graft. We should remember that malunion is still a serious problem in fracture treatment.

DR. FREDERICK A. BESLEY, Chairman of the Committee on Industrial Medicine and Traumatic Surgery, then gave a short address. Few medical schools have made changes corresponding in importance to the changes that have come about in the medical situation relative to industrial disease and injury. There is hope, however, for the inclusion of proper teaching material in postgraduate courses. General surgery, as such, seems to be disappearing. It is perhaps important that industrial medicine and traumatic surgery should have a special department in teaching surgeons to continue to blaze the way for the proper teaching of these subjects in the future. It is absolutely essential that we secure the proper cooperation of industry, insurance groups, executives, medical schools, and hospitals in the prosecution of this important program of technical education.

DR. EDMUND BUTLER, of San Francisco, spoke on "Injuries of the Chest and Abdomen." In figures showing that 300 persons die every day of injuries, there is a relative high percentage of injuries to the chest. The important symptoms are dyspnea and cyanosis, and shock exists in practically every case; it should be remembered that shock is often of real protection in the prevention of extreme exsanguination. Examples of various types of chest injuries, such as depression of the ribs, separation of the sternum, and separation of portions of the chest wall, were given, and advice as to treatment in these common types of injuries to the chest. Considered also was the treatment of pneumothorax, bullet wounds, stab wounds, and in contusions and lacerations of the lung substance, the technique of Stenbuck and Connors was suggested. So-called tension pneumothorax necessitates proper and prompt treatment. In hemothorax, the control of the hemorrhage may be obtained by packing sterile gauze by the use of a proctoscope. Aspiration of the blood may well be delayed until from three to five days after primary treatment. Lantern slides were shown illustrating traumatic diaphragmatic hernia, traumatic emphysema and hemopericardium. In abdominal injuries, the necessity for delay of treatment was discussed along with different causes of abdominal injuries and the method of occurrence of the injury. In 113 injuries, the site of the injury was found in the duodenum in 14 cases, in the jejunum in 44, in the ileum in 38, in the mesentery in 21, and in the colon in four. A discussion of the early symptoms and signs of abdominal injuries was presented. It is important to remember that mesenteric sloughs are always to be considered. The subject of the rupture of various viscera was discussed at great length. Finally, lantern slides depicting rupture of the bladder, air under the diaphragm in rupture of abdominal viscera, bubbles of air in the abdomen after rupture of the posterior wall of the duodenum, ruptured kidney with pyelogram, and rupture of the diaphragm and pneumothorax were demonstrated.

DR. M. N. NEWQUIST presented the subject "The Modern Concept of Industrial Medical Problems." In successfully working out the problem of adequate care of the health of industrial workmen, the lack of appreciation on the part of the employer, of the laws, and of various other factors has acted as handicaps to the successful solution of these problems. It is now thought that the attitude of the employer has changed considerably for the better, and also that the medical profession itself realizes to a great extent its own responsibility. However, more cooperation is needed and this will greatly enhance the results which are necessary. An important point is the provisions for proper medical and health care through organizations of staffs and direction of them by medical men.

First aid work is of importance, and can be administered through proper assistants. The use of existing hospital services rather than the creation of new ones is an important principle. The scope of industrial medical service covers pre-employment examinations; periodic examinations; and the care of industrial injuries and occupational diseases. Under the latter phase, the essayist presented a discussion of the administration of examinations, the advisability of using the Kahn test, and also the necessity for having standard forms—which the College now has available. In addition to the previous phases of medical service in industry, it is advisable to give first aid and advice to a reasonable extent for non-industrial illnesses and injuries, while the employee sustains these when on duty—beyond that, the employee should be referred to his own family physician. The medical supervision of plant sanitation and industrial health measures is also an important arm of the service and perhaps has been the most abused of any phase. During the past 10 years, there has been a 40% reduction in the severity rate of accidental injuries and a 60% reduction in the frequency. A map of the states in which occupational disease diability laws have been passed was shown, demonstrating that 20 states have such laws at the present time. Relative to absenteeism per employee in days per year, it was found that occupational diseases caused 0.01, industrial injuries 0.59, and non-industrial injuries and illness 8.85.

The per capita cost for medical care has risen from 88 cents in 1915 to $6.30 in 1932, although it was as low as $5.11 in 1936. In a study of 268 companies, which paid out more than four million dollars for medical care, it was found that 63% went to doctors and nurses; 15% to hospitals; 13% for administrative expense and 9% for supplies. The College has surveyed 1,657 organizations up to 1937, of which 843 have been approved, having been given a certificate of approval. In conclu-

sion, good medical and surgical service in industry is really an economic principle and not necessarily entirely humanitarian in trend.

DR. JAMES A. CAHILL, JR., of Washington, D. C., presented a very interesting discussion of the subject "Reconstruction of Scalp and Ear by Tube-Graft Method." In a summary of the literature it has been found that there are only 96 cases reported of complete scalping caused by machinery. In a case history which formed the greater part of this discussion, the details of the accident and the injury were outlined and in a large number of well-selected photographs on lantern slides, the various steps in operative procedures (a total of 11 plastic operations) demonstrated how a large avulsion of the scalp was successfully treated over a period totalling almost two years of time. The first procedure was started three weeks after the injury and consisted of grafting a flap from the left frontal region and subsequently using a tube-graft from underneath the scapula, followed later on by a larger tube-graft on the other side of the back. The demonstration was an unusual one and amply showed what time, persistence, and patience can do in restoring tissue after an extensive injury to the scalp.

DR. KRISTIAN G. HANSSON, New York City, presented the final paper on the program on "Physical Therapy in Relation to Industrial Surgery."

The essayist reviewed the history of physical therapy, mentioning the establishment in 1907 of a Council on Physical Therapy by the American Medical Association. An outline of the applications of physical therapy in industrial cases was then given. It was the belief of the speaker that 75% of industrial cases need some form of physical therapy, mainly heat and massage. Details were then given in three different types of cases: (1) application of physical therapy to fractures in which treatment should be supervised and directed by the surgeon responsible for the treatment of fractures; (2) application to infections of the hand in which the whirlpool bath and active exercises play so prominent a part along with continuous wet compresses—this method of treatment should also parallel the surgical treatment of the condition; and finally, (3) the application of physical therapy treatment was given. It is believed that the future development of physical therapy lies in the hands of the traumatic surgeon. It was pointed out that the Council on Physical Therapy sets up certain requirements for physical therapy technicians. In conclusion: (1) it is believed that 75% of industrial injuries require some form of physical therapy—of this 75%, 50% of cases need simple methods, while 25% require some type of physical therapy apparatus for adequate treatment; (2) surgeons are directly responsible for the whole treatment of injuries; (3) it is necessary to have properly trained technicians for this work; and (4) the physical therapy department in a hospital should be used as a reference department in a similar way as other departments of the hospital.

Early Diagnosis

—*In Mental Instability in Railroad Employees*—

W. O. McMILLAN, M.D.,
Charleston, West Virginia

WEBSTER, in his definition of "stable," quotes Chaucer in these words: "And to her husband ever meek and stable".*

We all know what "meek" means, and what a rare wife this one must have been, if she was meek. Maybe Chaucer knew some meek ones, as he wrote long before America was discovered or settled. Apparently, none of the descendants of Chaucer's woman were among the emigrants who first settled these United States. However, we have many stable ones, and if it is a high quality in a wife, it is an absolute essential to railroad men.

Returning to Webster, he says "stable" means: "Steady in purpose; constant; firm in resolution; not easily diverted from a purpose; not fickle or wavering; as, a man of stable character". On the Southern Division, as on other divisions, we make physical examinations of applicants for positions in train service, and at stated intervals after their employment. Some of the reasons for these examinations are so patent as to require no elucidation. We examine his eyes because he must not only be able to see, but also must distinguish colors. We examine his ears, because he must be able not only to see signals, but also to hear them. Then a man must climb onto engines and cars and off them; he must be able, should he be flagging, even to run. We hear, sometimes, of men dying of heart trouble at the throttle, or while going back to protect the train. Either such situation develops great jeopardy, so we examine their hearts and respiration.

We doubt if ever a man is examined, on his application to be a fireman, that someone, either the applicant or another person present, does not give expression to the ancient witticism: "All a fireman needs is a strong back and a weak mind".

It is probably true that there is no mechanical device in the world which captivates the mind of youth so much as a railroad engine. How many men have told you that their youthful ambition was to be a locomotive engineer? How many of you, if you were fortunate enough to be reared in a small town, where, perhaps, a few train crews lay over, who cannot remember the almost idolatrous veneration the boys had in your town for the locomotive engineers living there? Perhaps this is the reason that, as a class, railway engineers are generally accorded pre-eminence among the strictly operating men, while the conductors, although arrayed in blue uniforms and resplendent in brass buttons, unquestionably are second to the men in overalls, jumper and red handkerchief about their necks. By the time a fireman reaches the exalted position of having a

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regular run on a passenger train, whatever weakness his mind may originally have had, and whatever strength his back originally may have had, are forgotten in the glamour of his pre-eminence.

Perhaps you who are listening to me may think in your minds that I am inclined to be facetious, and that I do not regard with seriousness the importance of stability in these men. I realize as well as you the importance of railroading, and the most important part the men in train service and the men who dispatch the trains play in their functioning. The property and the lives of the nation are in the hands of these very employees and they must be able to coordinate their several functions unerringly and stably, if these lives are to be preserved and this property carried to its destination. The dispatcher has before him a train sheet, having on it the trains in movement on his division. Surely, his mind must be stable that he may coordinate the movement of these trains and prevent collisions, both head-end and rear. The conductor and engineer are jointly responsible for the safety of their trains, and their movement according to rules and orders. Surely, they must be steady in purpose, constant and unwavering, because many difficulties beset them between terminals.

It is wrong to say that a brakeman is only a helper to the conductor, and a fireman only a helper to the engineer. We all know that the brakeman on the train is held jointly for mishaps with the conductor, and the fireman jointly responsible with the engineer. The brakeman will sooner or later be a conductor, and often times it is necessary for the conductor to delegate to a brakeman some of his duties. Likewise an engineer must make use of his fireman, therefore, mental instability incapacitates a fireman or a brakeman as much as it does an engineman or conductor, and the fireman or the brakeman, on his very first trip, and before he is even considered as a permanent employee, can easily be guilty of such a mental aberration or slip as to cause loss of life and property.

In my judgment the early recognition of mental instability in railroad employees is second only in importance to the early recognition of cardiovascular disease. I express this opinion because cardiovascular disease may be, and frequently is, associated with sudden and unexpected disturbance of consciousness, and this in railroad employees, who must always be on the alert, may be of great danger to the lives and property of others a well as the company.

The manifestations of mental instability on the other hand are more gradual in their appearance and, therefore, their insidiousness makes for more difficulty in early recognition; but by careful history taking and delving into their past, we will not infrequently obtain valuable aid.

I SHALL take up a few of the commoner mental illnesses met with and briefly discuss them.

The first group: These mental pictures are not those of true instability as we might measure it in our rather ill-defined manner, but those who have not taken advantage of simple educational provisions—or who have done so and not succeeded. This group presents what might be termed a "mental atonic" group—or those that are just dumb. There is a place in the system for them for, as many of us know, a great many of the old, faithful employees fall in this group. They are indispensable and have proved of great service. However, it is our duty to see that they qualify for a certain type of occupation when we first examine them and that the members of this group be not found among the engineers, dispatchers, and more responsible operatives.

The next group: These might be classed as organic disorders.

Organic changes in the brain show varied degrees of clinical evidence. Some of these changes in individuals past 60 years, or even younger, may represent normal old age. In the railroad we are more concerned with the essentially mental clinical problems because they involve questions of responsibility. Invariably there are changes in character and mentality to be noted during the involutional period. Temperament, as a rule, becomes more equable and placid in the normal changes of old age. However in marked personality involutional changes, the reverse is the rule. Then we may expect excitability, irritability, irascibility, etc., which phases of character and temperament changes represent compensatory endeavors to try to hold a place in the busy every-day world. Again the recording faculty of memory is weakened; the brain refuses to retain impressions of recent current events or information recently acquired, with its former certainty and accuracy. Yet, it is a clinical fact that judgment may be unimpaired or, what is more interesting, that even from the greater deliberation of its mental processes the brain acquires a higher degree of this faculty. But old age is, in fact, a period of susceptibility to almost every kind of bacterial danger. Death may come acutely with a final bacterial infection, or from a mechanical accident to some part of a system of degenerated blood vessels, producing apoplexy in one of its forms.

In railroad employees we are much concerned about the formidable array of physical dangers of the life span beyond 50. Especially is this true of changes due to arteriosclerosis, syphilis and other disorganizing agencies which produce the same. Here is where history again becomes important as we review the problem case under consideration. Why is the history so important? Is it because we want to know of infection, also the early manifestations of the changes that go to make up the symptom complex? In organic diseases of the brain the history will usually show the following symptoms: headache, insomnia, restlessness, irritability, fatigue, dizziness, fainting, weakness, perhaps palsies—transitory or permanent—varying in degree and kind. Of these transitory palsies, aphasia is quite common; also amnesia, and, not infrequently, monoplegia. The mental defects are usually first shown in memory changes, then faulty associations, over-

suggestibility, stubbornness, suspiciousness, confusion, disorientation. In railroad employees we take cognizance of this group of cases of arteriopathic origin, largely because of the problems of retirement from service and the estimate of service value should they not be retired. The clinical pathology is variable in such case, but the fact remains that "a man is as old as his arteries."

There is one group of disorders which may, and is apt to, produce a marked degree of mental instability, which demands of the railroad surgeon special study and careful analysis. I allude to neurosyphilis with its very varied symptomatology.

NEUROSYPHILIS is receiving more consideration from the preventively-minded observer than ever before. Neurosyphilis is full of surprises from the time of suspicion of its presence in the problem case on into the care, and especially in the end results. Stokes reminds us that "habitual, painstaking, complete examination is the only means for the detection of the earliest objective signs. Some neurosyphilitic pictures lack specificity and not all neurologic symptoms in the course of syphilis are due to syphilis of the nervous system". The examining surgeon should apply the same objectivity to his diagnosis of neurosyphilis as to any other aspect of the disease. While the employee's subjective complaint may suggest it to him, much more often his first clue will be found in the eye signs and the lower cord reflexes, taken as a part of the routine physical examination. We are more concerned with brain neurosyphilis, as the problems which are to be met in this form have more direct effect upon the responsibilities of service than those of other periods. The importance of early recognition of brain syphilis as a clinical problem is self-evident.

Vascular neurosyphilis of the brain is rated as one of the common forms of neurosyphilis. The onset of vascular complications in the nervous system usually begins comparatively early in the course of syphilis; 25% between the second month and second year—the majority in the first three to five years of infection. Vascular accidents may happen without prodromal symptoms. The most common syndrome will show palsies—complete or incomplete. Seizures may be lacking and consciousness unaffected. Aphasia is a common accompaniment of the palsies. Pupillary changes are usually absent, but, as a rule, the Wassermann is positive.

The form of brain syphilis which concerns us most is paresis. Syphilis of the brain, in whatever form, may have mental symptoms. The psychotic background from which paretic neurosyphilis may be differentiated requires many times patience and perseverance.

The diagnosis of paresis places a great responsibility upon the examiner. The clinical, medico-legal, and social aspects of paresis present many problems. The proportion of neurosyphilitic cases, however, is no greater among railway employees than among farmers, according to the Mayo Clinic. We have to be sure of our diagnosis —because such a diagnosis is a serious matter. It involves not only the question of the individual's ability to fulfill the duties of the service he is called upon to perform, but concerns also the economic and social factors which involve himself and his family. The importance, too, of a proper diagnosis involves the responsibility of railroad surgeons and officials. The diagnosis of paresis in particular and neurosyphilis in general is not justified until confirmed by physical, mental and laboratory findings. The combined positive findings of all three diagnostic methods cannot be confounded with any other disease.

Another group—which I can only mention—is the varied one of epilepsies. We all know the importance of history in making our diagnosis and recognizing this unfortunate entity. It is my opinion that there is no place in the railway system for these to be employed, as we all know they are potentially, at all times, a liability to the lives of others as well as their own, and, as well, to the property of others.

It is my hope that by early recognizing the instabilities of the railway's mental make-up, we can eliminate the weak from the strong and thereby make for better efficiency in the personnel of our railroads.

The Management of Intra-Ocular Foreign Bodies

WILLIAM H. EVANS, M.D.,
Youngstown, Ohio

INDUSTRY, as a whole, has made great strides in reducing accidents that were extremely common 15 or more years ago.* In 1923 Allport[1] reported that 35% of the shop injuries at the Pullman Company were eye injuries; and at the American Steel Foundries eye accidents were reduced 75% in two years by insisting that the men wear goggles while at work. Our experience leads us to believe that the foregoing statements are very conservative.

However, the ophthalmologist located in an industrial community still sees eye injuries of every description, and each year he sees many patients with intra-ocular foreign bodies.

In every case of eye injury, especially if it has been caused as a result of using a hammer and a cold chisel or from striking metal or stone with a hammer, a very complete history should be taken and a thorough examination of both eyes should be done.

The examination should consist of checking the vision of both eyes, and an external examination for abrasions or wounds of the cornea, conjunctiva, sclera, iris, and lens. This is usually done by means of a lens and loupe both before and after staining with fluorescin or 2% mercurochrome. Pupillary reaction should be noted, as it is not an uncommon occurrence to find a change in shape

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or size of the pupil of the injured eye if the foreign body has penetrated the iris. Following this, much information may be gained by ophthalmoscopic examination; transillumination is also extremely valuable in noting a tear of the iris. The slit lamp should be used in all cases, as it will give definite information as to whether there is a perforation of the cornea, iris or lens.

After this examination a temporary dressing is applied and the patient referred to a hospital. In most instances it is advisable to instill atropine followed by bichloride mercury unguentum, 1-3000, and apply a sterile dressing. However, in a few instances, when the foreign body is in the anterior chamber, it may prove of decided advantage to contract the pupil with eserine or pilocarpine and defer using atropine until after the foreign body is removed. This minimizes the danger of loosing the foreign body behind the iris. Neither is there much danger of injuring the iris and lens during removal, and, I believe, iris prolapse should be less frequent.

In regard to x-ray examination, it appears that this should be done in every case—not necessarily before removal, if the foreign body can be seen, but most assuredly afterwards, as there are numerous instances on record where an eye harbored more than one foreign body. In some cases both eyes should be x-rayed if there is the least suspicion that the fellow member has been injured. Mills and Jeancon[2] have pointed out the legal obligations of the physician to procure an x-ray where there is the remotest possibility of an intra-ocular foreign body. They described 21 cases of intra-ocular foreign bodies that had been unrecognized or inadequately treated by other ophthalmologists.

If the lens is cataractous, or if there is hemorrhage obscuring a view of the fundus, localization should be resorted to before there is an attempt at removal. If x-ray examination is negative the magnet test may prove helpful in determining if a magnetic foreign body is present.

Soon after the patient is seen, often before he leaves the office, he is given some form of foreign protein, either 20 million of triple typhoid vaccine intravenously, 5 cc. of boiled milk or of lactigen intra-muscularly, or 20,000 units of diphtheria antitoxin subcutaneously. This is repeated every three to four days during convalescence. Acetyl salicylic acid gr. X every three hours, or sodium salicylate, is also given routinely.

In view of the fact that there is a chance of intra-ocular infection in all penetrating wounds of the eye and that sulfanilamide has proved effective in the treatment of infections of beta-hemolytic streptococcus,[3] staphylococcus[4] and gonococcus,[5] also in meningococcic meningitis[4] and gas gangrene[7] (B. welchii) I have felt justified in using it in prophylactic doses of 5 gr. every four hours for the first few days. Although unable to state its value I believe its use should be continued until conclusions can be made.

Blake[8] says foreign bodies in the globe sometimes change their position, migrating a considerable distance from the point where they were first observed. At times the migration extends until the foreign body is spontaneously expelled. Blake saw two such cases. He states that the extrusion is not limited to any particular substance. Copper, however, is well known to be the least tolerated of the metals.

Foreign bodies are often spontaneously extruded from, or near, the original point of penetration. This is explained by the contraction of a fibrinous band extending from that point of perforation to the foreign body, and also by the fact that suppuration at the point of entrance weakens the wall at this point.

There are no reported cases of foreign bodies migrating from before backward. Suggestions as to why the foreign body moves forward, in addition to those above, are: compression of globe by extra-ocular muscles; pull on the choroid by ciliary muscle in accommodation; and through action of currents in the intra-ocular fluids.

While copper is the commonest metal which produces suppuration, lead is the least irritating. Glass causes little reaction, and no case has been reported where glass has been spontaneously extruded.

The location of a foreign body must be considered. Copper, for example, on the iris or ciliary body, results in suppuration, while in the lens it may not even cause complete opacification. In the vitreous it may be tolerated for long periods.

OKABE[9] studied histological sections from 14 cases of perforating injuries of the globe after perforation by various metals, and investigated the action of the common metals on the retinae of rabbits—with the following conclusions:

1. Particles of iron in the vitreous with no infection produce a degeneration of the retina, but no purulent inflammation. The degeneration begins in the visual cell layer of the retina. The pigment epithelium undergoes definite changes: the connection of these cells is loosened and fuchsin liberated. In the final stage, the parenchyma is atrophied, and the glial tissue is hypertrophied. All the layers of the retina contain cells with fuchsin.

2. Copper and brass produce a suppuration surrounding the foreign body. All layers of the retina present a granular degeneration. The nuclear atrophy disappears first in the outer granular layer and then in the inner layers.

3. Nickel produces a purulent inflammation of the vitreous. The nerve layer degenerates and hypertrophies, and is followed by degeneration of the visual cells of the retina. The particles of nickel ultimately become encapsulated with firm connective tissue.

4. Lead does not produce a purulent inflammation. Degeneration of the retina occurs slowly. The ganglion cells and the nerve fibers are affected.

5. The retina is affected proportionately to the location of these metals and to the tissue which intervenes before the encapsulation occurs.

6. The encapsulation depends on the location and the kind of metal. Pieces of nickel form the

earliest and strongest capsule. Next in order come copper and brass. Iron and lead are usually free, but may become incompletely encapsulated.

In determining the procedure to be used in removing intra-ocular foreign bodies, it is essential to know if the foreign body is magnetic or non-magnetic; also its location in the globe and its size. For that reason the discussion is made under the following headings:

Magnetic Foreign Bodies

MAGNETIC FOREIGN BODIES in the anterior chamber:

As these are the most accessible they are usually the easiest to remove, but care must be taken not to injure the iris or lens. If the foreign body is incarcerated in the iris it should be freed by use of the magnet before making a corneal incision. The incision should be just large enough to allow the foreign body to pass through, and care should be taken not to allow the aqueous to escape from the anterior chamber. Verhoeff[10] advises making the corneal incision far back on the limbus and in close proximity to the foreign body, no matter where it is located in the anterior chamber. He insists there is little or no danger of iris prolapse, as the incision is small, and that there is less danger of scratching the anterior lens capsule by refraining from moving it around in the anterior chamber.

However, I have experienced no difficulty in attracting the foreign body to a point near 12:00 o'clock, by use of a small hand magnet, and then making the incision at that point. Unless the wound of entrance is a large, gaping one, and the foreign body is of unusually large size, it is better not to run the risk of enlarging it and producing added scarring by extracting the foreign body through the corneal route.

MAGNETIC FOREIGN BODIES in the lens:

Occasionally one encounters a foreign body of this type with the lens not cataractous and with normal vision. I believe one is justified in refraining from removing it immediately. However, the patient should be told of the existing foreign body and his most probable loss of vision. But no foreign body should be allowed to remain in an eye without referring the patient for consultation. This protects the surgeon against unjust criticism and a possible suit for malpractice. Within the past year I have seen two different patients with small particles of steel in the lens. Each had a corrected vision of 20/20. They were both kept under observation, and within a period of three months from time of injury, it became necessary to remove the foreign body from each of the eyes, followed by needling and extraction of the lens.

If, at the time the patient is seen, the lens is cataractous, both lens and foreign body may be removed at one sitting. Often, following injury to the lens, a marked increase in intra-ocular tension will result, secondary to swelling of the lens. The lens should be removed at once, as irreparable damage to the optic nerve will result if the tension remains high over an extended period.

MAGNETIC FOREIGN BODIES in the vitreous:

Intelligent management of cases falling in this category requires a high degree of skill and an unlimited amount of patience, as it is well known that many complications may occur—with or without removal. Every case presents its individual problems, and the ingenuity of the operator is often sorely taxed. Generally speaking, if the lens has been injured it is advisable to remove the foreign body by the anterior route. If difficulty is encountered in bringing it into the anterior chamber, needle the lens and wait a day or two until it has time to soften. Then, through a keratome incision, the lens can be removed by irrigation and expression; often the foreign body can be brought into the anterior chamber and extracted. Where the foreign body is sufficiently small I have attempted to follow the teaching of Haab[11] by pulling it between the lens and iris into the anterior chamber and removing it as described above. To perform this procedure it is essential the pupil be dilated as widely as possible. It will be found advantageous to use an ointment of suprarenin bitartrate 1%, or small cotton pledgets saturated in 1-1000 adrenalin chloride solution and placed beneath both the upper and lower lids, in addition to solutions of atropine, homatropine and 4% cocaine. This will allow extraction of many foreign bodies that otherwise would be caught in the iris, producing irreparable damage. Even with the marked mydriasis obtained by the method described above it is often necessary to perform an iridectomy or to remove the foreign body from the iris by means of a forceps.

Occasionally, after repeated attempts on succeeding days, it is impossible to bring the foreign body into the anterior chamber. It will then be necessary to remove it through a scleral incision—most operators preferring either to enlarge the site of entrance if there is a scleral wound or to make an incision through the sclera as close to the foreign body as possible, and remove it by using a small magnet. Verhoeff[10] insists the safest procedure is to make an incision about 5 mm. back of the limbus, parallel to the ora serrata, and remove it through the pars plana of the ciliary body. His technique is described as follows:

"Within the past few years I have, I believe, made the operation still safer by incising the sclera gradually. Instead of plunging a cataract knife directly through the ocular wall into the vitreous as is usually done, I employ a large knife needle, the point of which has been filed off. A Post knife needle or a very large Knapp knife needle will serve. After dissecting up a conjunctival flap and inserting a suture ready to tie, with repeated sweeps of the cutting edge of the knife needle an incision is made in the sclera, parallel to the ora serrata at a distance of about 5 mm. from the limbus. Great care is taken not to incise the ciliary body. After the sclera is partly cut through, one edge of the incision is grasped with fixation forceps and the incision into the perichoroidal space completed by forcing the blunt point of the knife beneath the remaining scleral fibers and then cutting outward. The large hand magnet applied

to the wound will now cause the ciliary body to bulge. If the foreign body is small and sharp it may at once come out through the ciliary body. It it does not, a small cut is made in the ciliary body and the magnet again tried. If the foreign body still fails to come out, the cut is enlarged to the extent necessary as found by repeated trials."

If the foreign body is of large size it is essential it be removed through the point of entrance, whether that be through the sclera or cornea. Moore[12] points out the fact that where a foreign body is very small and of hard steel and is buried in the retina or choroid the posterior route is almost imperative, as this type of foreign body is apt to be of high grade alloy — and steel of this type is not as magnetic as softer steel or iron.

Non-Magnetic Foreign Bodies

NON-MAGNETIC FOREIGN BODIES in the anterior chamber:

Many foreign bodies in the anterior chamber can be removed by forceps through a corneal incision with little or no trauma to the eye, but the type of foreign body present should be the deciding factor in determining whether it is to be removed if there is to be much trauma to the eye. As is well known, glass, stone, lead and aluminum, are tolerated much longer without reaction than is copper or brass. However, in all cases, a conservative attempt should be made to remove all foreign particles.

For removal of non-magnetic foreign bodies near the angle of the anterior chamber Connell[13] advises a corneal incision about 3 mm. within the limbus, with the point of the keratome pointing toward the limbus and passing through the cornea at an angle of 45°. This prevents prolapse of the iris and allows free access to the foreign body with the forceps.

NON-MAGNETIC FOREIGN BODIES in the lens:

If the lens is non-cataractous I am inclined to allow the foreign body to remain undisturbed but to inform the patient (or the parents, if a child) of danger to be expected. If the lens is cataractous, both should be removed. In 1924 Donovan[14] described a method of removal by suction. He used a beveled needle about the caliber of a spinal puncture needle, attached to a piston syringe. In removing the foreign body he kept the beveled side of the needle down, but in removing the lens material he advises that the beveled portion be turned up. He advises a portion of the lens be allowed to remain to prevent possible loss of vitreous.

NON-MAGNETIC FOREIGN BODIES in the vitreous:

These are usually of the sort most frequently left in place, and, as is well known, usually produce a reaction resulting in the ultimate loss of the eye. For that reason it is advisable to make some reasonable attempt at removal in those cases where the foreign body can be seen and appears to be accessible. However, it is my belief that the operation should be discontinued if hemorrhage obscures the view of the operator before the foreign body is recovered, as prolonged manipulation will only hasten the loss of an eye that is already doomed for destruction. Both Cross[15] and Thorpe[16] have devised forceps for removal of shot in the vitreous, and Thorpe[17] has devised an ocular endoscope, but I have had no experience with their use.

Cross[15,18] has described his technique in removing non-magnetic intra-ocular foreign bodies with the aid of a bi-plane fluoroscope, but this is not practical for the average operator in a small community as most hospitals lack the proper equipment. This means that the patient should be referred to an ophthalmologist who has had experience in performing this difficult procedure and who has the proper instruments and access to a double-plane fluoroscope and the aid of a roentgenologist familiar with this type of work. In other words, to perform this operation successfully requires an operating team that few of us are able to have at our command.

Complications

PANOPHTHALMITIS: Marked intra-ocular infection should be treated by evisceration or enucleation. I prefer evisceration as I have seen two patients who died from meningitis following an enucleation of a badly infected eye.

(b) IRITIS and IRIDOCYCLITIS: These are frequent complications. Marshall[19] reported 42% in his series. For that reason atropine should be used early and frequently along with foreign protein, salicylates, hot compresses, etc.

(c) SEPARATION of the retina often occurs, especially where the wound of entrance is through the sclera, or where the foreign body has been removed through a scleral incision. Duggan[20] states that 52.8% of the patients in his series with either an accidental or operative scleral wound were complicated by detachment or vitreous exudates, or both. In 25 cases reviewed by Barkan and Barkan[21] where foreign bodies were removed by the posterior route there were seven cases of retinal detachment.

(d) MOST authors warn against the dangers of sympathetic involvement of the fellow eye, and rightly so, as we are never certain when it will appear. For that reason, if for no other, the patient should be kept under observation for an indefinite period.

(e) GLAUCOMA is of fairly frequent occurrence following eye injuries and the extraction of foreign bodies. The tension of the eye should be watched closely for any sign of the condition and proper treatment instituted.

The reasons given for the above complications are: infection, trauma, and contraction of scar tissue.

I wish to urge again the use of sulfanilamide in the hope that infections, of any degree, will be prevented, and I further urge that a thorough search be made for any focus of infection and that it be removed at the earliest possible time. Also, that in patients with scleral wounds or incisions, a cautery, diathermy, or thermophore be used over the area involved, with the hope of preventing a separation of the retina. Finally, all of these patients should be hospitalized and, I believe, in

injuries of the posterior segment both eyes should be bandaged from three to seven days, or longer, depending on the severity of the injury.

Kiehle[22] has pointed out the fact that the story is not fully told as soon as the foreign body is removed, but due to the frequency of changes that are apt to take place in the eye the patient should be kept under observation for a period of years.

Comment and Conclusions

IN THE case of every patient with a history of an ocular injury a complete and careful history and a thorough examination of both eyes is indicated, and x-ray examination should be made in practically all cases.

2. Every patient with an intra-ocular foreign body should be hospitalized.

3. Routine use of foreign protein, sulfanilamide and salicylates is indicated, with the hope of preventing and combating infection.

4. Early and frequent use of atropine is indicated in the majority of these eyes.

5. Make haste slowly in determining the procedure to be used in each individual case.

6. Traumatize the eye as little possible remembering most of the graver complications are a direct result of trauma or infection.

7. Use of the cautery, thermophore or electrocoagulation is indicated where there has been a wound or incision made in the sclera, with the hope of preventing separation of the retina.

8. Search for and eliminate all foci of infection as soon as the patient's condition will permit.

9. Explain to the patient, or some responsible member of his family, the gravity of the condition.

10. Do not hesitate to ask for consultation, as very little commendation will be received no matter how brilliant the result but much criticism is apt to be directed your way, even though every possible effort has been made to save the patient's sight.

11. Keep the patient under observation for possible visual changes that may occur at any time following injury and removal of a foreign body.

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Swallowed Glass

R. E. NEWBERRY, M.D.,
Atlanta, Georgia

THE depression years have been marked by an ever increasing number of claims against insurance companies for alleged accidents caused by the swallowing of glass particles, either in soft drinks, ice cream, canned foods, or in food served in restaurants. At a time when companies have needed most to conserve resources some have been threatened seriously by these growing demands for damages. Some of the claims have been made in good faith with the claimant truly believing that he had swallowed glass, but by far the larger percentage of these suits have been schemes for obtaining money.

The larger bottling concerns, chief defendants in law suits of this type, use every known precaution in preventing any glass particles in their products, since their bottles are routinely inspected in an ultraviolet light by a specially trained worker.

The experiments presented in this paper will prove, we believe, that the ingestion of glass does not have any harmful effect on the intestinal tract and that, should it be true that the claimant actually swallowed glass, he would experience no harmful effects.

The first experiment in this group was made on a patient, P. W. F., on November 22, 1934. The patient, a white man aged 53 years, married (with one child), five feet eleven inches in height, weight 165 pounds, had a good general appearance.

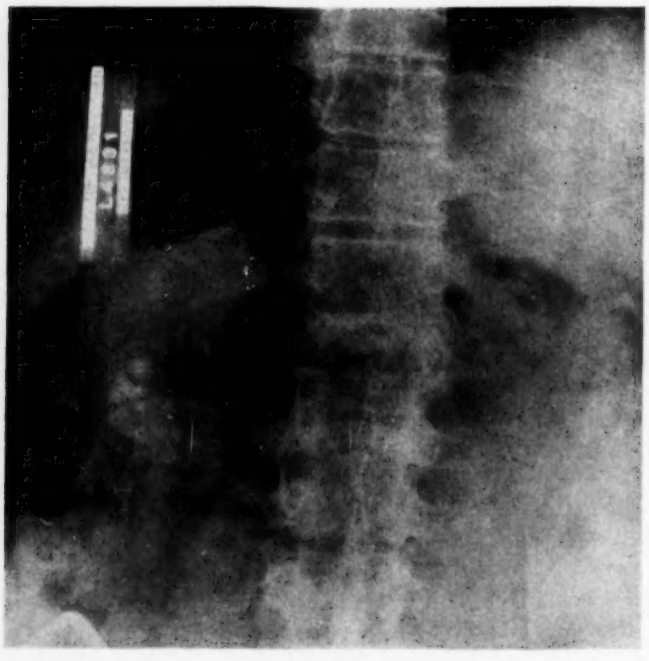
He had suffered no serious illnesses, had had no operations, and, at the time of the experiment,

was working as curator of the museum at Emory University, in Emory University, Georgia.

This man swallowed 18 pieces of a broken beverage bottle and then ate an apple. An x-ray was made of his stomach immediately, in which the glass showed distinctly. He was allowed to continue work and was kept on a normal diet. At no time did he experience any ill effects such as nausea, vomiting, etc. He was unable to detect any abdominal pain while the glass was in his intestinal tract nor did he notice any bleeding or discomfort when the glass was passed from the rectum. The following table shows the length of time the glass remained in his intestines and the rate at which it was passed:

Hours after Meal	Movement	Pieces Passed
9	1st	none
21	2nd	4
27	3rd	none
44	4th	none
46	5th	7
60	6th	4
70	7th	2
75	8th	1

The experiment has been repeated many times, with the patient swallowing glass from all kinds of soft drink bottles, in pieces ranging from ¾



Thirteen of the pieces of swallowed glass are easily distinguishable

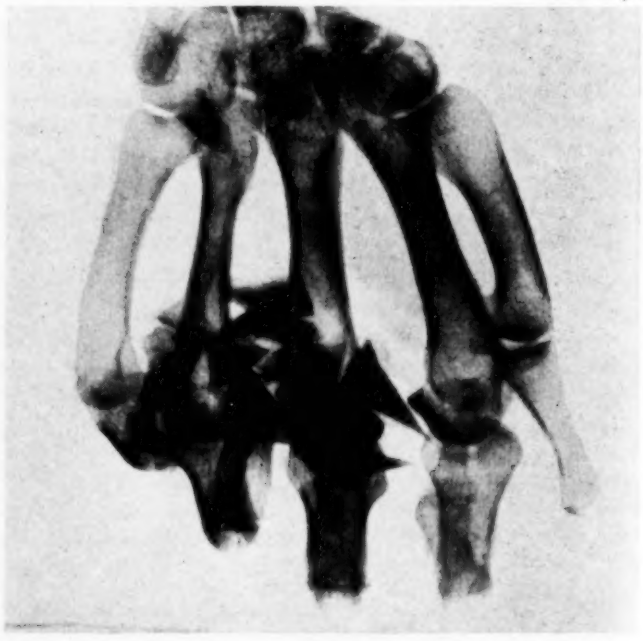
of an inch long to ½ inch wide. He has also eaten powdered glass on sandwiches, and in ice cream, with no ill effects.

On October 14, 1937, 14 pieces of glass from a broken beverage bottle were swallowed. In the accompanying x-ray, taken at this time, 13 of the pieces are easily distinguishable. Another x-ray of the patient holding pieces of the same type of glass in his hand is also reproduced for comparison.

WE HAVE examined a great many cases, the ages of the claimants ranging from four years up to men and women of advanced years. All manner of claims have been presented, with widely varying symptoms, some even claiming total and permanent disability. These claims have often been substantiated by reputable physicians who had treated the claimant, but so far we have never found a case alleging disability that was a direct result of the ingestion of glass. A recent case where we were called to testify may serve as an example.

A man claimed that he had eaten some ice cream about three years previously and thought he had swallowed a piece of glass. Since that time he had suffered from colitis, with occasional bleeding from the rectum. This rectal bleeding was proved to be due to hemorrhoids, and a verdict was rendered for the defendant. During the cross-examination in this case several hypothetical questions were propounded by the opposing counsel which indicated that the defense, or the surgeons whom they had consulted, had only a vague knowledge of this curious and enigmatical condition and therefore supposed it to be due to glass.

PROGNOSIS: The prognosis as regards life is good. So far as we have been able to determine, there is no reason for any disability in these cases.



The comparative sizes, and the supposedly dangerous shapes, of the swallowed glass are shown by this x-ray of pieces of the same type of glass held in the hand

TREATMENT: In all the cases we have examined no treatment has been given because none was necessary.

The patient was advised to continue working, to eat regularly of a normal diet, and to take no laxatives.

After a period of from one to three days the glass has been passed.

No evidence of any constitutional reaction to this condition has been detected.

Low Back Conditions

—Diagnosis and Treatment—

James P. Cole, M.D.,
Buffalo, New York

THE PROBLEM of low back pain is acute, especially in industrial medicine, for I am informed from insurance carriers that from 5 to 10% of employees develop symptoms in the low back during the course of their work.*

By far the most vulnerable portion of the low back, and the one usually at fault in causing low back pain and sciatica, is the lumbosacral junction. Even under the soundest of mechanical arrangements which one might encounter at this joint, it is still subjected to a considerabe degree of strain. It is the junction of the movable lumbar spine with the relatively immovable pelvis, and, because of this, strains and stresses are diffused to it. The junction is also constantly under strain because of the fact that the axis of the body weight falls anterior to it, and as the fifth lumbar vertebra does not rest upon the sacrum in the horizontal plane the entire weight of the trunk and extraneous loads tends to shear the fifth lumbar vertebra off the sacrum, failing to do so because of the lateral articulations and the supportive structures of the spine. The foramina between the fifth lumbar and the first sacral vertebrae are very often the smallest of the intervertebral foraminae, yet they carry the largest nerves. This accounts in many instances for the presence of sciatica with low back pain, for the fifth lumbar nerves are more easily strained or compressed.

During youth the musculature and ligamentous support of this junction is usually adequate. With increase in age, however, these structures become weakened, producing decompensation at this point with the resultant symptoms we so commonly know.

Being the last portion of the spine to develop, many anomalies occur in this region. These anomalies increase the vulnerability of this junction and may lead to decompensation. I will demonstrate what is thought to be a fairly normal lumbosacral junction, and will illustrate some of the anomalies which occur in this region.

Normal Lumbosacral Junction: The most stable lumbar articulations are those which are in a saggital plane. These allow flexion and extension motion without decreasing their efficiency. They also keep lateral and rotatory motion at the minimum. The angle at which the fifth lumbar vertebra rests upon the sacrum should be 45° or less. The nearer this plane is to the horizontal the better, for as this angle increases the shearing stress increases.

Asymmetrical Articulations: In this type of junction between the fifth lumbar and the first sacral one lateral articulation is placed in a saggital plane while the other is in the coronal. To best illustrate what might happen with such an arrangement I would like to draw an analogy between this and a door upon which one hinge has been placed in one plane while the other is in the opposite. If one attempts to open the door with such an arrangement a torque-like motion takes place. Such a situation at the lumbosacral junction places a strain upon the joints and their ligamentous support.

Coronal Articulations: These allow a greater degree of lateral motion than those which are in the saggital plane, and in allowing flexion and extension they do so at the expense of stability.

Posterior Displacement of the Fifth Lumbar Vertebra: This anomaly is usually developmental, although it can be acquired as a result of atrophy of the intervertebral disc which allows the fifth lumbar to sink backward on the sacrum. The anomaly is always associated with coronal articulations, and will cause low back symptoms, for the intervertebral foraminae are decreased in size and because of the coronal articulations more lateral motion can occur.

Transitional Fifth Lumbar Vertebrae: These are sometimes called sacralized fifth lumbar vertebra or lumbarized first sacral vertebra. Such a vertebra will cause symptoms of a low back nature when unilateral by tending to pry away the transitional vertebra through the medium of the transverse process which acts as a lever on it. With both the unilateral and bilateral types motion is extremely faulty. Always with transitional fifth lumbar vertebra, the intervertebral foraminae are narrowed leading to the possibility of nerve root involvement.

Spondylolisthesis: This is a developmental anomaly caused by failure of union between the laminae and the pedicles of a vertebra. With such a condition the vertebral body tends to displace anteriorly, thus placing a strain upon the supportive apparatus of that vertebra. The most common place for spondylolisthesis to occur is at the fifth lumbar.

Increased Lumbosacral Angle: Normally the lumbosacral is 40° to 45° from the horizontal, and any increase in this angulation will cause a greater shearing stress of the fifth lumbar vertebra on the sacrum, leading to muscle and ligamentous strain.

Ruptured Nucleus Pulposus: Strictly speaking this is a neurological problem. However, in the examination of a patient with low back pain and sciatica one should keep this lesion in mind, for it is a real entity and an occasional offender in the production of low back pain and sciatica.

Sacro-iliac Joints: Owing to the fact that these have the strongest support of any joints in the body, there are no nerves in proximity to the joints and there is such an unstable mechanism lying immediately above them, I can scarcely attribute the cause for any case of low back pain and sciatica as originating through faults in this mechanism.

Osteoarthritis and Marie-Strümpell spondylitis should be watched for in roentgenograms of the low back, and also fractures of the spine and spinal cord tumors should be considered.

* Presented at the Seventeenth Annual Meeting of the New York State Society of Industrial Medicine, Corning, New York, November 4, 1937.

Owing to lack of time I have purposely neglected in the discussion of the diagnosis of these conditions the physical and historical examination of this type of case. They both are very important and each case should be critically scrutinized in these two phases of diagnosis.

Treatment

FOR the sake of convenience I shall discuss the treatment of these cases by dividing them into those who have mild, moderate, or severe symptoms.

The mild cases should be given light exercise for the abdominal and spinal muscles, and defects in posture should be remedied. Massage which usually can be carried out at home is beneficial, and these patients should sleep on a firm bed in order to reduce spinal sag.

Cases with moderate symptoms should be given some sort of supportive apparatus such as the lumbosacral belt with a Cooke pad, or, in those cases with arthritis, a short Taylor brace is sometimes beneficial. The type of treatment which has been outlined for those cases with mild symptoms should be carried out by those with moderate.

In the severe cases bed-rest is indicated, and while in bed the patient should have traction exerted upon both legs. Massage and radiant heat should be given, and many times sedatives are required. After the severe symptoms have subsided the treatment of this type of case should follow that which has been described for those having moderate symptoms.

Operative Treatment

THERE are a few cases, perhaps 10%, who will not respond to the conservative measures that have been mentioned, and these require more radical procedures. A release of the tensor fascia lata is indicated upon a patient who has not responded to conservative measures and in whom sciatica is the predominant symptom. This operation can be done very easily under local anesthesia, and the period of hospitalization is but a few days. Gratifying results can be obtained in approximately 75% of all such cases. In those cases which will not respond to conservative treatment and in whom the low back symptoms are cardinal, and when one is unable to diagnose a ruptured nucleus pulposus, a spinal cord tumor, extensive osteoarthritis or spondylitis, spine fusion of the fifth lumbar to the first sacral is indicated. Through the medium of this operation the fifth lumbar vertebra is placed at complete rest and the trunk is supported upon the fourth lumbar, which rests upon the fifth lumbar at a nearly horizontal plane, thereby decreasing shearing stress.

The mortality rate following this operation is less than 0.5% and morbidity is no more than one expects after the repair of a simple hernia. The period of hospitalization is from six to seven weeks, and the patient is able to return to light work after 10 weeks and to heavy labor within four or five months. A colleague of mine, Dr. Kimberly, of Portland, Oregon, estimated that 71% of 681 patients treated by such an operation in the New York Orthopaedic Hospital obtained an excellent result. That means that they were completely relieved of low back pain and sciatica and they returned to their former occupations. Of the same group of patients 7.2% had 75 to 90% relief, and 8.7% had a 50 to 75% relief; 13.3% of these patients had no relief but none was any worse than before the operation.

Certainly these unbiased statistics warrant a great respect for spine fusion and release of the tensor fascia lata in the treatment of those cases which fail to respond to conservative measures.

In closing I would offer to you as a suggestion, and I hope it will be feasible, a prophylatic measure which I am sure will reduce for industrial medicine the number of cases of low back complaint. If roentgenograms of the low back are taken of those individuals engaged in hard labor, the many anomalous conditions of the lumbosacral junction will be recognized. Through this means those individuals with vulnerable low backs could be watched more carefully or else placed in lighter work. The incidence of these patients would decrease in industrial medicine, leading to better protection to the insurance carrier and employer, as well as improving the working status of the employee.

Fractures of the Os Calcis

C. W. WOODALL, M.D., F.A.C.S.,
Schenectady, New York

FRACTURES of the os calcis, particularly those which are comminuted and involve the sub-astragalar joint, have long been recognized as among the most disabling fractures with which we deal, both as to the length of primary disability and percentage of permanent loss of use.* This has been especially impressed upon us, whose practice includes a large amount of compensation work, for, after all, most fractured os calces occur in men employed in construction trades such as carpenters, painters, bricklayers, etc., who are subject to falls. As railroad surgeons, we occasionally encounter the condition in trainmen who have fallen from the top of box cars.

In illustration of the possible disability following these fractures, let me quote from Kessler[1] in his work on Medico-Legal Aspects of Workmen's Compensation and Public Liability. He allows a minimum period of temporary disability of three to four months, and in unusual cases eight to 12 months. He reports 71 cases with permanent disability allowed by the compensation courts of from 25% to 100%, 51 of the total 71 having permanent partial disability ranging upward from 40%. His report of these cases came out about the time the Boehler method of treatment became popularized and they were probably not treated by that

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* From the Surgical Service of E. MacD. Stanton, M.D., and C. W. Woodall, M.D., Ellis Hospital, Schenectady, New York; read at the Annual Meeting of the Association of Surgeons of the New York Central System, Cleveland, Ohio, September 14, 1937.

method. The results shown, however, serve to impress one with the seriousness of the condition and the necessity of using any treatment which will shorten the period of primary disability and lessen the percentage of permanent incapacity.

Lasher and Henson[2] report much better results. In their series of 16 cases the highest permanent disability rate given is 45% with an average of 25%. Three had no permanent disability, and two were as yet undetermined. They advocate the Boehler method as the most satisfactory treatment.

About one year ago MacAusland[3] published the end results in a series of fractures of the os calcis treated by pin traction. In 13 fractures in 11 patients which had been followed from one and a half to four years, he made his evaluation on the fitness of the patient to return to his occupation in industry. Ten of the 11 patients either had or could have returned to their normal work. He compared the above results with three other groups of cases. GROUP 1: 20 crushing fractures treated at the MacAusland Clinic from 1906 to 1930 by manipulation and plaster cast. Twelve of these were traced after a number of years and examination made. Of these 12, seven were found to have the typical deformity and permanent disability which so often follow fractures of the os calcis. The other five were about 90% normal. GROUP 2: consisted of 61 cases of long standing seen at the Clinic, but apparently cared for elsewhere originally, which had received either no treatment or simple baking and massage or manipulation. All of these complained of pain swelling, and restricted lateral motion of the foot. Arthritis of the sub-astragalar joint was a common finding. No patient had returned to his original form of work. GROUP 3: comprised 17 cases treated elsewhere in the French method of open reduction and elevating the thalamus. Out of 17 cases 13 were reported as good results, three mediocre, and one poor. Good results in these cases were claimed when sub-astragalar arthrodesis was obtained. His conclusion is that the Boehler pin traction method meets perfectly the problem of treatment in the case of crushing fracture of the os calcis.

One of the best reports of results of fractures of the os calcis in recent literature is that of Jaekle and Clark[6] who treated 43 of these cases occurring during the construction of Boulder Dam. All of the serious fractures with displacement were treated by the Boehler method. Compensation ratings of permanent disability averaged 15.1% for comminuted fractures of the body, 3.2% for fractures of the tuberosity, 1% for fractures into the calcaneocuboid joint, and 0% for one fracture through the neck. Thirty-eight of the 43 cases had an average rating of 4.29% permanent disability and average time off 5.32 months. They conclude that "the Boehler method of treatment with anatomical reposition of fragments gives the least disability of any accepted method of treatment with emphasis upon immediate reduction in all cases."

The percentage of permanent functional disability in fractures of the os calcis seems to have a very definite relationship to the excellence with which the anatomical structure is restored. There are several methods being used to make this restoration, the best known of these being the Boehler[4] method. Professor Boehler came to America and presented his treatment before the American Orthopedic Association in June, 1930. About one year before, I had visited his clinic in Vienna and had seen two cases of comminuted fracture of the os calcis, involving the sub-astragalar joint, with marked initial displacement, widening of the heel, and destruction of the plantar arch. X-rays taken after reduction showed the arch restored, the squashing deformity eliminated, and the normal angular line of the superior surface of the calcaneum replaced.

DR. BOEHLER explained his method of reduction which, in brief, is as follows:

1. Releasing impaction of the fragments by placing the sole over a wooden wedge and forcing the foot into strong plantar flexion.

2. Inserting pins through the lower end of the tibia and the tuberosity of the calcaneum in its posterior upper corner.

3. Traction on the pin through the os calcis in the screw extension apparatus with the knee in flexion, first in the long axis of the leg in order to pull the tuberosity of the os calcis downward and restore the tuber-joint angle, and then in the direction of the axis of the os calcis to overcome the shortening of the bone and the axial deviation in the transverse plane. Again traction is applied in the horizontal plane and any broadening of the heel is corrected by means of a screw vise until the two heels are the same in width.

Following x-ray check, the leg and foot are encased in a plaster cast. After approximately one month, the pins are removed and a new cast applied incorporating a walking stirrup. This remains from nine to 14 weeks after the injury. Complete functional ability of the foot is obtained in from four to eight months, varying with the age of the patient and the severity of the fracture. Boehler states that "when the form of the crushed os calcis has been successfully restored in the manner described, the gait becomes normal, pronation and supination become partly or even completely free, the patient can walk on his toes, and has a normal play of the foot."

Last February Dr. C. W. Goff[5] described an apparatus for the reduction of fractures of the os calcis which employs the same principles as the Boehler method but with the use of nothing but a carpenter's wooden clamp with attached rounded and crescent-shaped wooden blocks. He reports five cases treated with apparently excellent results. The simplicity of this apparatus with its universal availability would seem to recommend it to those who do not have the Boehler equipment. For complete description of the method, one should refer to Dr. Goff's original article.

The open reduction of calcaneum fractures with a primary arthrodesis is advocated by some orthopedists. While this method may give satis-

factory results in the hands of certain operators, it seems to me that it is not generally as suitable throughout industry as the closed methods because of the added danger of infection and the specialized technique necessary. The open reduction treatment undoubtedly had an important place before Boehler demonstrated that anatomical replacement could be made by a mechanical, closed method.

SUMMARY: 1. Fractures of the os calcis, if not properly reduced, are likely to leave serious permanent disability, painful to the patient and expensive to the compensation carrier.

2. Ordinary manipulation, cast, and physiotherapy are inadequate forms of treatment in most cases, as they do not restore the anatomical structure so necessary for weight bearing.

3. Some form of closed reduction with positive control of fragments such as the Boehler, seems at the present time to be the method of choice. This method, if properly carried out, gives excellent anatomical reduction and a minimum of permanent disability.

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Obesity

LEO K. CAMPBELL, M.D.,
Assistant Professor of Medicine,
University of Chicago

THE most frequently encountered disorder of metabolism is obesity. Failure on the part of the physician to be sympathetic and direct an adequate and safe reducing program will lead even an intelligent obese patient into the hands of a charlatan or to quack remedies. The laity should be taught that obesity is detrimental to good health and that this is especially true if the individual has the substratum of diabetes mellitus, arterial hypertension, or osteoarthritis. Diabetes mellitus very often has its onset at a time when the body weight is at its peak, and the glucose tolerance in an established case will fall if the individual becomes overweight. The incidence of arterial hypertension and hypertensive heart disease is much higher in the obese than in individuals of normal weight. There is an added load thrown on the heart, for the vascular bed is enlarged, the fat pad offers a resistance to the capillaries, and the blood volume flow is increased because more energy is required to carry the added weight. Cognizance of the factor of obesity is of definite value in the treatment of hypertension, for there are a few cases in which a reduction in blood pressure will accompany the loss of weight. Osteoarthritis of the knees, weakening of the arches, and abnormal posture with its associated pathology and discomfort, are prevalent in the obese. One who is overweight is sluggish mentally as well as physically, tires easily, often can not give the best of his ability to his employer because of the handicap of carrying excess weight. The span of life in the obese is much shorter than in those of normal or slightly less than normal weight.

Obesity is best classified into two main groups: the non-pathological and the pathological types. The common "garden variety," or non-patholgical, obesity makes up about 90 to 97% of all the cases and is merely due to perverted eating habits. An individual consumes more calories than are expended and the excess are store as fat. In an urban population there are very few adults who take adequate exercise. Eating habits developed during adolesence when the demands of physical activity necessitate a large food intake are continued and the weight increases. An intake of only 100 calories a day above the energy expenditure will increase the weight about 15 to 20 pounds in a year. From his study on total heat elimination and total water exchange, L. H. Newburgh believes that obesity is never directly caused by abnormal metabolism but that it is always due to food habits not adjusted to the metabolic requirements—that either more food is ingested than is normally needed or there is a failure to reduce the intake in response to a lowered requirement. However, most investigators are of the opinion that a small number, probably 3 to 10% of all cases of obesity, are definitely associated with evidence of disturbed metabolism, some of which are on a hereditary basis.

In the pathological group, the obesity is accompanied by symptoms and signs of one or several of the following metabolic anomalies:

1. Hypothyroidism;
2. Pituitary dysfunction or disease of the tuber-cinereum;
3. Adrenal cortex disease;
4. Ovarian and testicular hypofunction;

Besides the accompanying symptoms and signs of the endocrine disturbance, patients with these types of pathological obesity have an anomaly in fat matabolism in that they will develop only a slight fasting ketosis as compared to a heavy fasting ketosis in the cases of the simple non-pathological obesity or in the non-obese. More than 20 years ago in the absence of experimental data, Folin wrote: "Since fat persons tend to store fat more readily than lean ones, they probably tend to utilize it less readily." There is undoubtedly a group of obese individuals that will fail to lose weight on diets in which the caloric value is far below their requirements as calculated from our present knowledge. This type of anomaly in fat

* Read before the Congress of Railway Surgeons, September 20, 1937, Chicago.

metabolism may accompany diabetes mellitus and is probably due to pituitary and gonad factors.

THE diagnosis of obesity usually presents very little difficulty. The physical appearance of the individual is sufficient ordinarily to make the diagnosis simple. Obesity usually does not develop rapidly and is well advanced before the patient seeks medical advice. One must differentiate:

1. MYXDEMA, which is accompanied by associated symptoms of hypothyroidism, such as dry skin, dry and brittle hair, typical facial appearance, mental retardation, intolerance to cold, constipation, and a low metabolic rate.

2. EDEMA. Occasionally widespread anasarca with ascites may superficially resemble obesity. However, careful physical examination will render the diagnosis a simple one.

3. AVITAMINOSIS. During the recent financial depression and in certain long standing cases having inadequate food, mineral and vitamin deficiencies produce a puffy appearance of the skin simulating obesity.

DURING these days of fads in reducing diets, many of which contain insufficient protein to maintain nitrogen equilibrium, physiologic accidents are not uncommon. A diet containing lower quantities of protein than that required to replace protein catabolism tends toward a lowered resistance, infections, nutritional anemia, degenerative lesions in vital tissues, and a fall in blood pressure. The type of diet advocated in this paper affords much more protein than is required, for a high protein diet will prevent protein deprivation in the tissues, hunger, and actually speeds up the metabolism about 7% above that of an isocaloric low-protein high-carbohydrate diet. The diet should provide two grams of protein per kilogram at ideal body weight, a caloric value of 10 to 20% below that required for basal maintenance, and sufficient bulk in the high-fiber-containing vegetables to prevent hunger and constipation. tI should be distinctive and arranged to fit the living conditions of the individual. A sample diet for an individual who should weigh 132 pounds (60 kilograms) may contain:

Vegetables, 5%	— 600 grams
Fruit, 10%	— 100 grams
Egg	— 2 grams
Lean meat	— 400 grams
Butter	— 15 grams
White bread	— 60 grams

This diet contains 60 grams carbohydrate, 124 grams protein, 86 grams fat, and will afford 1,510 calories.

A patient should be given a thorough training in quantitative dietetics, equipped with food scales and an exchange list based on caloric values so that the diet may be varied and monotony avoided. By employing only quantitative diets the protein and caloric content are assured, physiologic accidents prevented, and a satisfactory weight loss of from two to three pounds a week obtained. Qualitatively restricted diets, although sometimes satisfactory, are unreliable and often nutritionally inadequate. The variation in caloric content of qualitatively restricted diets often necessitates violent exercise to produce a continous weight loss. Excessive exercise may be inadvisable because of accompanying heart disease or osteoarthritis.

However, a quantitative diet is often impractical because of the living or working conditions and preformed habits. One could hardly expect a ruddy engineer who has been accustomed to a rough and strenuous life to enter an institution for instruction in quantitative dietetics so that he may reduce his weight, all of which is absurd to him. In such a case a less rigid qualitatively restricted diet may suffice: viz., three quarts of milk would contain 1,140 calories, three medium sized oranges would contain approximately 180 calories and one and one half pounds of green vegetables, which is as much as one ordinarily eats, would contain 100 calories. A palatable salad dressing made of mineral oil could be used. A diet such as this would have a total caloric value of 1,400 calories. Apples, peaches, pears, or grapefruit could be substituted for the oranges with but little change in the caloric value. Three eggs could be substituted for one pint of milk. A diet as simple as this could be used under almost all conditions.

SOME cases of obesity are associated with mild hyperinsulinism with its accompanying hunger and these patients are much more comfortable and less likely to discard the diet if 10 or 12 small feedings are given instead of the customary three larger ones. Individuals who attempt to reduce by omitting a meal usually make up the caloric intake by eating a much larger amount of food in the other meals. A patient who has been accustomed to eating enormous quantities of food will have a large stretched stomach and more gastric secretions than one eating less food. Hunger may be annoying until the stomach contracts to a normal capacity which often requires several weeks. Frequent feedings are advantageous in these cases.

A patient on a reducing diet usually does not show a continuous constant rate of weight loss. Often the weight will remain stationary for several days because water takes the place of the absorbed fat. This water may leave the tissues during a few hours and the individual excrete large quantities of urine. We have seen four to five pounds lost overnight by this phenomenon.

IN THE treatment of the group with hypothyroidism, a high protein diet should be accompanied by sufficient dessicated thyroid extract to bring the basal metabolism up to a normal level. Those of the pituitary type with the Froehlich's syndrome are best treated with a high protein diet accompanied by a large dose of the anterior pituitary like sex hormone. This may be given in doses of 200 rat units every five days and repeated if necessary.

The indiscriminate use of thyroid extract and

other drugs should be discouraged. Alpha dinitrophenol was introduced about three years ago into the therapeutics of obesity. The drug in doses of 3 to 5 miligrams per kilogram body weight will produce a sustained increase in metabolism and body heat. Its indiscriminate use by the public has led to some fatalities. We have seen bilateral cataracts, arterial hypertension with cerebral accidents, and permanent pigmentation in the skin of patients who purchased the drug from the pharmacist and used it without the direction of the physician. The use of a drug with such a small margin of safety should be discouraged.

Some of the railroads, especially the Chicago, Milwaukee, St. Paul, and Pacific, have recognized the value of the prevention and treatment of obesity in their employees. This is highly advisable and should be universal among the railroads as well as other industries employing large numbers of people.

Discussion:

DR. ROLLIN T. WOODYATT, Chicago: I have very little to add to what Dr. Campbell has said. From a practical standpoint in accomplishing weight reduction, one frequently has to recognize the intense hunger and weakness of some patients between meals. In some of the cases, as Dr. Campbell has said, the blood sugar percentage may fall to subnormal levels, so that the complaints those patients make are not to be attributed to weakness of character, but they are due to physical causes. In some of these cases the plan of giving small amounts of carbohydrate at frequent intervals, as in the form of skim milk or some fruit juice such as pineapple juice, is very effective, because it enables the patient to get by these periods. Recently I saw the case of a young man who was working in a radio station. An attempt had been made to reduce his weight. A diet was made up but he felt so badly and was so weak during the working hours that it affected his job. That man with 100 grams of skim milk every hour or two was able to accomplish his duties without difficulty.

Medicomment

ONE of the lesser pleasures of these years from which the larger ones seem to have taken leave, is listening to those who voted for what they've got complaining now because they've got it.

In British Columbia last summer the citizens held a plebiscite on the question: "Are you in favor of a comprehensive scheme of health insurance progressively applied?" The returns stood 110,000 for, and 77,000 against. But there's a sequel. The following is from DR. MCGOLDRICK'S column in *Medical Times*, of August, 1937:

"The physicians of British Columbia have refused to serve under the compulsory health insurance mandate of the government at a dollar for the *first* call by day and a dollar and a half at night, with corresponding rates for other services.

"Everything was nicely arranged by the uplifters. The measure was passed in 1936 through a deal with the Socialist wing of the opposition, and the Provincial Secretary has been hard at work ever since making preparations for its enforcement. He leased a large building and hired an army of statisticians and 'socialicians'. A beautiful set of regulations was worked out by these bureaucrats, the act having left details to the organization that was to be created.

"Services were announced as 'mandatory' and 'permissive' benefits, the latter dependent upon funds being available at some future date. The mandatory benefits included the services of the doctor.

"Oddly enough, nobody had thought of consulting the medical profession for the purpose of obtaining their views and their consent. It was just as though the uplifters and the government had arranged to take over the conduct of the 'cure of souls,' without benefit of the clergy's opinions or consent.

"Sensibly enough, the medical men 'decided to have nothing to do with the scheme,' lit their pipes, smiled amiably, and looked away.

"It seems now that the government and people of British Columbia are bewildered, and 'nobody seems to have any idea what to do,' although the silly thing, remember, is a *mandate*. Coercion has been talked about, with its proponents looking rather foolish the while.

"The law of the country is suspended through this incredible blunder on the part of the up-lifters and politicians, and $83,900 has been spent by the bureaucrats.

"Although a plebiscite on the question has been held, nothing but further confusion has emerged out of the muddle. One hundred thousand of those who went to the polls voted blank ballots on the question. The government's sick chicken has come home to roost. The future of the sorry scheme is in doubt.

"It seems to us that this episode in British Columbia is weighty in significance for American Columbia, that is to say, the United States. Our Canadian brethren have set us a fascinating example in a cockeyed era.

"We are unable to think of *any* form of compulsory health insurance that would not merit identical contempt."

AT THE medical section of the American Life convention recently held in Colorado Springs in June Dr. Cragin, in his opening address, gave the results of a questionnaire from 197 companies in regard to the amounts paid the medical profession in the year 1936. For medical fees, plus compensation, plus accident and health *and leaving out state insurance, automobile liability, self-carriers, contract practice, a large portion of group and industrial payments;* the figure reached the stupendous sum of $70,386,097.42. (Our italics.)

"From reliable sources an estimate can be made of well over $100,000,000 paid by all companies for medical services in the United States. It was estimated that about $800,000,000 was paid for medical services by individuals in this same year, and it is also interesting to note that $360,000,000 was paid for patent medicine."

Doesn't that last figure suggest a whole lot with reference to the alleged indigent, alleged to be without medical care?

Industrial Medicine

Reg. U. S. Pat. Off.

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Advertise

AN ARTICLE in one of the several magazines which are published by organized industrial groups, describes the business of a concern which has a history of nearly 150 years of successful operation. The industrial relations policies of this company are referred to as "outstanding," and are described in the article in brief outline, with the inference, however, that they have been and are of considerable importance as contributing to the company's high standing. Hours, pay, permanent job tenure, awards for suggestions, bonuses, clubs and activities, credit union, vacations—all are mentioned.

This is a nice list; it represents a reality of personnel relations which is superlatively creditable. But it is an incomplete list, even so, for nothing whatever is said about the excellent medical measures the company maintains for its employees.

It would be pleasing to believe this omission occurred because it is as much taken for granted that a successful company has a medical service for its employees as it is taken for granted that such a company has owners, directors, officers, plant, equipment, product—and employees. But that, as yet, is not the case.

Of course, workmen's compensation is not mentioned either. That, no doubt, *is* taken for granted —along with such necessary evils as taxes. Medical departments, however, are quite something else—to an extent that begins where all similarities cease. Both are preventive; both will recognize their ultimate effectiveness when nothing happens—neither accidents nor sicknesses. Meanwhile the one is a matter of statute law, with its economic advantages accruing directly in theory, but because of the varied interpretations of the statutes, only indirectly in practice. The other is a matter of statutes to some extent, in so far as occupational diseases are concerned.

Beyond that, it is a matter of forthright economics.

And there, the industrial medical department takes its place along with every other improvement of a business which makes that business more successful, and with every embellishment of a product which makes that product more desirable.

THE president of a large hotel chain not long ago expressed his thanks to a guest for the latter's appreciation of some of the smaller and little noticed conveniences provided for his comfort, and went on to say that he wanted to keep ahead of all competitors in such matters, and was trying to think of still others that he could talk about in the company's advertising. The guest replied: "Ever advertise your very fine medical department? It isn't so little, but it seems mighty effective." The other replied that he hadn't thought of that. "Well, said the guest, "here's an idea. Go get the American College of Surgeons to look you over; build up to their requirements for a rating, and then *advertise* the fact that you've got it."

That was particularly good advice for a hotel man; his contacts with those who buy what he has to sell are so almost intimate, and his medical facilities, extending to his guests, are a part of what he offers his buyers. But it is also, if less directly, good advice for all businesses. Medical services for employees have a definite importance in every kind of producer-consumer contact. This may begin at the point where the employee and his family are themselves the consumers—the less *earning* time lost on account of sickness, the more earned money to be spent on the conveniences of life. Or it may involve only the indirect, almost intangible, relation to competitors where the same reduced aggregate of *working* time lost on account of sickness is reflected in a lower cost of production. But wherever it fits, it should be talked about. It should be advertised consistently, in all of the many ways in which such advertising is possible, until it is as much taken for granted as any other element of the commercial good will. To put it directly, preventive medicine, and particularly that part of it represented by *industrial* preventive medicine, needs a public relations counsellor—or, in words which, perhaps, are more simple in quick application, a press agent. This is a suggestion to the industrial medical organizations.

Occupational Diseases and Industrial Surgery

Back Injuries as an Industrial Disability

BECAUSE of their frequency and importance, the present discussion of back injuries is limited chiefly to those of the lower portion of the back.* Falls from a considerable height, voilent direct blows, severe torsion, and severe flexion and extension injuries of the back, account for the severe lesions of the bony spine, the cord and their neighboring structures. With increasing knowledge and present-day aids in examination, we have become fairly familiar with these injuries and their treatment. The evaluation of damage to the structures and the resulting disability can be made objectively and usually presents no serious difficulty. With these injuries I am not concerning myself in this discussion.

A great number, however, of back injuries encountered in industrial and other accidents are not of this severe type. They are usually injuries of the lower back and may be produced by similar but less violent forces, and usually follow a heavy lift or suden twist or an unguarded movement of the body, and in general suggest a strain or sprain of the joints of the lower lumbar vetebrae, the sacrum and the ilia or of the neighboring muscles. It is these cases that frequently lead to prolonged and often unexplained disability. Strain of muscles or ligaments results from over stretching. It may be acute or chronic. In the chronic form we see this strain resulting from faulty posture and faulty body mechanics, and prolonged use of the body in a faulty or cramped position, as may be required in certain occupations. Sprain of a joint results from movement beyond the normal range of the joint, thus producing a stretching and tearing of ligaments. There occur bleeding, clotting, granulating and eventually healing by scarring. Careful consideration of the accident, the manner in which the force was applied, location of the tender area and movements which cause an aggravation or an easing of the pain, may aid in determining the ligament or muscle injured. Rest and protection of the injured area for a period of about six weeks, f llowed by gradually increasing movements and use of the injured structures, suffice for recovery in most cases. Slight injuries require a shorter time, while the more severe or multiple tears require a longer period of protection and a longer time for recovery. Recovery from such strains and sprains should occur as does recovery from similar injuries in other parts of the body. With return of normal back movement and the disapearance of muscle spasm, the average individual should be able, to some extent at least, to resume his former activities.

Illustrative of the type of back injury that I have in mind is the personal experience, as detailed in one of his letters, of Erasmus, of Rotterdam, in 1514. While traveling from Calais to St. Omer, where he had spent spent a couple of days with his old friend, the Abbot of St. Bertin, he writes:

"Scarcely had I left a certain inn which lies halfway betwen Roulers and Ghent, when my horse shied at some white clothes which were spread on the grass and, while I was bent over to say something to my servant, the animal bounded in the oposite direction, and so twisted the end of my spine that I was compelled to cry out, so intolerable was the pain. I tried to dismount, but I could not, so my servant placed me on the ground by allowing me to

* J. R. KUTH, M.D., Duluth, Minnesota; read before the Northwest Industrial Conference in connection with the Annual Meeting of the Minnesota State Medical Association, St. Paul, Minnesota, May 5, 1937; published in *Minnesota Medicine*, November, 1937.

Occupational Diseases

The General Assembly of the State of Illinois has recently passed an Act, covering occupational diseases of Industrial employees. This Act is particularly concerned with diseases of the lungs, and poisoning from certain chemicals.

Under this new law it will be necessary for many industries to examine their present employees, and new employees, to determine their present health status and thereby prevent future liability.

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THE BULLETIN

of

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THE object of this Association shall be to foster the study and discussion of the problems peculiar to the practice of industrial medicine and surgery; to develop methods adapted to the conservation of health among workers in the industries; to promote a more general understanding of the purposes and results of the medical care of employees, and to unite into one organization members of the medical profession specializing in industrial medicine and surgery for the mutual advancement in the practice of their profession.

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lean on him, while the pain continued atrociously, especially if I bent over. I suffered less when erect, but I could not straighten up when once I had assumed a bent posture. There I was in the open country with no inn to go to but one which was most cold and uninviting, and I was six long miles from Ghent. I felt the pain less in walking, and yet it was too long a journey for even a sound man to accomplish on foot. Imagine my state of mind. I made a vow to Saint Paul to finish my commentary on the Epistle to the Romans if I could only get out of this fix. A little while after this I was driven in desperation to try whether or not I could mount my horse, and succeeded beyond my expectation; I amble slowly, and find I can bear it; I order the servant to go a little more quickly, and still stand it well, but not entirely without pain. Well, I reach Ghent, dismount and get to my room; but thereupon the pain starts all over again, especially after the lull. I cannot stand except when supported on either side in an erect position and firmly; for if I bend over to the slightest degree then that intolerable pain returns. Nor could I sit up, and when lying down I could not move at all. I send for the doctor and apothecary. I was so done up in every way that I thought of nothing but death.

"In the morning, while preparing to relieve nature I try to get out of bed, and am successful; I stand, I move, I sit and without assistance. I give thanks to God and Saint Paul. There remains still a slight soreness from which I am not yet free."[1]

It is in this type of back injury, as described by Erasmus, that we often find recovery to be excessively slow or even doubtful. Individuals young, middle-aged and elderly return to the doctor with monotonous regularity to have their backs taped, to lie under hot lamps, be treated by diathermy, etc. They seek out one doctor after another and are sent from one examiner to the other. Insurance companies complain of difficulty in obtaining a correct diagnosis, if a diagnosis at all, in these cases, and comment on the great divergency in the diagnoses given. From the hodge-podge of a great number of these cases they conclude that one method of treatment is as good as another and dispose of these cases by compromise as well as they can, in over 75% of the cases. It is these cases which, as Osgood aptly says, leave a sense of confusion in our minds. He adds, "Until we sense this confusion we cannot begin to be clear headed."[2]

Obviously, it is only by a most painstaking, careful and thorough examination, and often by re-examination at intervals, that some if not all of this confusion can be dispelled, the injuries more properly evaluated and therefore better treated.

Examination

CAREFUL and painstaking examination should comprise the following:

1. A careful history of the accident, the kind of force, its severity and direction, and manner in which it was applied.

2. A careful history of previous back injuries and previous back disabilities, especially of previous recurring attacks of so-called catches or cricks and lumbago. Likewise, a history of past infection.

3. Examination of the patient stripped.

(a) Observation of the general nutrition, build and musculature, noting any static defects or abnormalities and deformities, the gait, postural abnormalities, body lists, etc.

(b) Location of pain and points of tenderness, manner in which pain radiates. It is well to have the patient himself outline with his finger the points and areas of pain and tenderness.

(c) The range of back movement, whether movement is limited actively or passively, and the direction in which it is limited; the effect of movement on pain, whether it aggravates or relieves the pain; the presence or absence of muscle spasm during movement of the back should be noted, remembering that spasm of a muscle is an objective and very persistent condition, and not to be

confused with normal, voluntary or obviously purposeless muscle contraction. Examination as to back movement should be carried out with the patient in the standing and in the sitting position.

(d) The lower extremities are examined for movement, size, length and condition of muscle and vascular structures. No examination of these cases should be concluded without applying the various well recognized signs and tests described by Trendelenburg, Goldthwaite, Gaenslen and Ober, as well as the application of the straight leg raising test.

(e) At least a minimum, but careful, neurological examination, including muscle function, sensation, the reflexes, state of equilibrium and ocular reflexes, is important in all cases. Where definite nerve lesions are uncovered, a thorough and complete neurological examination is most important. In selected cases this should be supplemented by the Queckenstedt test and perhaps by lipiodol filling of the lower spinal canal for x-ray visualization of obstructions or deformities.

(f) Routine examination of the mouth and throat, and probably in many cases of the sinuses as well, for foci of infection, and rectal examination of the prostate and the sacrum should conclude the physical examination. In certain cases further clinical and special laboratory examinations may be necessary.

(g) X-ray examination should be undertaken in all cases of low back injury which at the end of two to three weeks show no progressive improvement, and in all individuals past 40 such examinations should be made sooner. The films should be technically good, and show the injured area in two planes, and, when possible, in an oblique plane (so-called three-quarter oblique view) to visualize the small joints formed by the articular processes. Films taken with the patient in the lithotomy position may show the lumbo-sacral joints to better advantage. Stereoscopic films are generally helpful and frequently quite important. In some cases it is important to retake films which are apparently negative.

The general behavior of the individual during the examination is, at times, helpful in the final summing up of the case.

Physical Findings

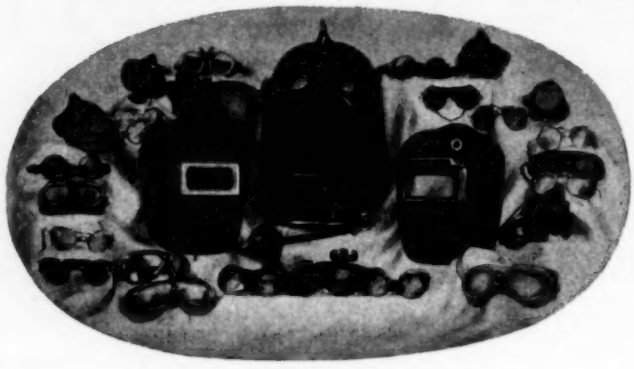
FOLLOWING some such examination as briefly outlined, one may encounter conditions which may or may not have a bearing on injuries, complaints or disability in question. One may find no objective evidence of injury or disability.

1. An obviously poor state of health, especially if associated with progressive loss of weight, should arouse suspicion of serious systemic disease or local disease of the spine which may or may not be related to a perhaps slight and trivial back injury. Important in this connection are tuberculosis, other serious infections, and neoplasms of the spine.

Flat-foot or a short leg or stiffness and deformity in the larger joints of the lower extremities may cause chronic strain in the lower back which, when an acute traumatic strain is added, will account for slowness of recovery from such injuries. Persistent faulty posture as well as occupational strain can similarly prolong disability after injury. Body list to one side, more or less fixed, is indicative of muscle or joint lesion.

2. Persistent local pain and tenderness which is constant as to location suggests the seat of a lesion, traumatic or otherwise. Radiating pain is frequently complained of. Radiation of pain from the lower back into the buttocks or thigh (so-called sciatic pain) is often found associated with a body list either toward or away from the painful side.

3. Stiffness is a common sign of back disease or injury. The passively stiff back—so-called poker back—is frequently found in chronic, ankylosing arthritis from infection and in the so-called Strumpel-Marie or rhizomyelitic type of ankylosing spondylitis. In the latter type the hips and shoulders are frequently involved in a similar ankylosis. With complete ankylosis, these backs are usually painless and without muscle spasm. The x-ray appearances of these lesions when fully developed are usually characteristic. Early in the acute stage of infectious arthritis



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pain, stiffness and muscle spasm exist without demonstrable changes in the bony spine on x-ray examination.

In the back with limited movement only, one may see a small section of the spine—one or two joints—fused by reason of previous injury or disease. Degenerative changes or developmental disorders of the spine may account for some cases of limited movement. More often, the limitation of movement is due to spasm or to structural shortening of muscle groups and ligamentous structures. It is in this latter group that one finds associated limited movement in the lower extremities elicited by certain tests and maneuvers.

4. The radiating pain, especially pain with so-called sciatic distribution, is a common symptom in many low back lesions. It should be distinguished from a true neuritis and should be considered as a symptom only. Persistent muscle group weakness or persistent anesthesia in an extremity or in the peri-anal (saddle) area in chronic and recurring post-traumatic low back pain suggest:

(a) Pressure on a nerve root by spinal anomalies, displacements or productive lesions.

(b) Pressure on the cord or cauda equina by neoplasms within these structures or arising from neighboring bony or soft structures.

(c) Pressure within the spinal canal from displacement of a calcified or dislodged nucleus pulposus or the protrusion of an intervertebral disc.

(d) A true neuritis of the sciatic nerve as a manifestation of an infection in which the back may also be involved.

(e) The darting and radiating pains of tabes.

A true sciatic neuritis is probably very rare. Progression of symptoms without intermission suggests malignancy.

5. Infections, general and specific, are well known causes of acute and chronic low back pain and disability. Of these, Pott's disease, because of its own importance, and the difficulty of its diagnosis early in adults, should always be considered. Post-typhoid infection, osteomyelitis and syphilis of the spine are rare. Examination of the stripped patient may reveal an acute gonorrheal infection which might otherwise be overlooked and which may play an important part in an actual or alleged back injury. Certain forms of progressive arthritis, especially of the ankylosing type, may result from a focus of infection. A certain number of cases of chronic low back pain, post-traumatic and with a tendency to recurrence, are at times improved or completely relieved by removal of such foci of infection. It is, however, a matter of every-day observation that in many of these cases of post-traumatic low back disability we find the symptoms continue after the removal of all foci, real and suspected. Removal of obvious foci of infection is warranted in many of these aggravated cases. Careful general physical examination with adequate laboratory assistance is important in uncovering latent and hidden foci of infection.

6. The x-ray in the post-traumatic back may disclose:

(a) No obvious deviation from what may be considered a standard for the normal. This does not prelude the presence of lesions (acute arthritis, Kümmel's disease, slipped fibrocartilage in the joints of the articulating processes, early tuberculosis or malignancy before bone changes are evident, et cetera). Subsequent x-rays taken at intervals of several months may reveal osseous changes.

(b) Congenital anomalies (alterations in size and shape and sacralization of the transverse processes of the fifth lumbar vertebra, spina bifida, articulations between spinous processes, alteration of the size and shape and direction of the articular facet, etc.

(c) Displacements (spondylolisthesis, displacement of intervertebral discs, small tear fractures of bodies, etc.

(d) Developmental changes in the bodies (congenitally wedged vertebræ, osteochondritis, protruded nucleus pulposus and subsequent alteration of the bodies associated with the names of Schmorl and Scheuermann, etc.

(e) Ankylosis (from preceding disease or injury).

(f) Destructive lesions (tuberculosis, typhoid fever, tumors, fibrocystic disease).

(g) Proliferative changes (osteomyelitis, syphilis, Charcot joint). Also hypertrophic changes noted on the edges of the vertebral bodies of the so-called hypertrophic or chronic osteoarthritis.

(h) Changes about the sacro-iliac joints and ilia, spurring, fusion, areas of destruction (tumors, tuberculosis, osteomyelitis, condensing osteitis, etc.)

It has been estimated that anomalies of the lumbosacral area are more frequently met with than not. Of these anomalies, some are probably a source of strength and others a source of weakness. Accessory joints in areas of less than normal movement are more easily injured and would recover from such injury more slowly than otherwise. Proliferative changes in the smaller joints, that is, of the articular processes, are undoubtedly of greater significance than similar changes in the larger joints between the vertebral bodies. A slipping forward of the body of the fifth lumbar vertebra on the sacrum is occasionally detected on physical examination and noted in the x-ray film. This condition (spondylolisthesis) to be produced accidentally at one time would require great force, and could be presumed to cause immediate severe total disability. In most cases, the condition is dependent on a congenital weakness or anomaly of the fifth lumbar vertebra and is usually produced gradually as a static deformity. It is not infrequently met with in x-ray films of individuals who have had only a comparatively slight injury which was followed by mild or moderate disability. In these cases the condition existed at the time of the accident in question and was not caused by it.

Very commonly, in persons past 40, with or without previous back disability, one sees changes at the edges of the vertebral bodies, the articular processes or the sacro-iliac joint margins, consisting of spiny outgrowths or spurring, and usually referred to as chronic hypertrophic or osteoarthritic changes. These changes are essentially degenerative in character, depend more on senescence and abnormal wear than they do on infection or other causes. Certain it is that, in a generalized form, they are not traumatic in the sense that they are due to one single severe trauma. Early x-rays usually show the changes advanced to a degree inconsistent with the brief period of time between the accident and the taking of the x-rays. These changes, when moderate, may cause but little, if any, discomfort or disability. They may limit movements of the back more or less, but rarely do they go on to complete ankylosis. When these changes are marked in the spine, the back movements may show severe limitation. These backs undoubtedly are more susceptible to strain and injury (or fracture of a spur) and when so injured are slow to recover. They probably account for most of the cases of low back disability following comparatively trivial injuries.

This so-called "hypertrophic arthritis" should not be confused with a process of rapid fusion of the lateral apposing margins of the vertebral bodies by large, thick "crescents" or "spangles" in individuals between the ages of twenty and forty and which represent a true infectious spondylitis.

Traumatic or other lesions of the sacro-iliac joint are evidenced by pain and tenderness over the joint and aggravation of the pain and tenderness by movement of the ilia on the sacrum, as elicited by tests which spread or compress the ilia or which cause a forward and backward rocking of the ilia on the sacrum. In disease of the joint, the x-ray may reveal the lesion (tuberculosis, arthritis or osteitis of the ilia). In the supposedly traumatic lesions, x-ray, as a rule, shows nothing obviously abnormal. The sacroiliac joint has movement and therefore may be strained or sprained, but subluxations, if they do occur, are generally impossible of definite demonstration. Occasionally there may be noted sufficient displacement of pubic bones at the symphysis to suggest subluxations or abnormal looseness of the

joint. Following severe violent accidents considerable dislocation may be seen at the sacro-iliac joints in the x-ray. This condition, however, not under consideration here, does not cause the complaints and physical findings of chronic low back injury.

The Objectively Negative Back

THOSE patients who, after repeated, thorough examinations, show no objective abnormalities, or only minor ones, but persist in their complaints, form a troublesome and often trying group which plague the doctor. Outstanding in this group is the apparent excessiveness of complaint and the disproportion of the complaints to the physical findings. In these patients, the complaints which have persisted unduly long do not conform to the experience in other cases with similar back accidents. In certain ones there has developed a neurosis, in others an unfavorable mental attitude, while a few are made up of malingerers.

1. The hysterical back betrays itself by its highly dramatic quality, manifested in peculiarity of posture and gait, nondescript tremor, excessive perspiration, general anxiety and an unbearable tenderness on the slightest pressure. Added to these, one finds other stigmata of hysteria. From this extreme there are other cases less dramatic but which, on careful review of the accident, the varied and excessive complaints, the general background and behavior of the patient, lead to the diagnosis of an underlying neurosis.

2. The unfavorable mental attitude, in which the thought of compensation and the struggle between employee and employer become fixed ideas, is an obstruction to recovery. These form a group which present a problem in low back injuries. During a fairly close association with industrial accidents for 12 years prior to our present workmen's compensation act, the writer noted no such problem. In Germany, with the establishment of the first compensation act in 1885. the German physician was astonished at "the immense number of nervous workmen lacking in energy in whom the thought of compensation became a fixed idea.'" With the establishment of the French accident law in 1898, A. Brissaud "expressed astonishment at the advent of a condition which he states was the unexpected effect of the compensation law and which he described as a new disease under the name of 'sinistrosis.' He calls this a 'psychical accident' caused by the fixed idea which has taken possession of the injured workman that every accident occurring in the course of work constitutes a damage admitting of indemnity. He claims that the preoccupation of the patient in still feeling he has pain becomes an obsession and is, in reality, a disease,'" Sir John Collie, noting the

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effect of the English workmen's compensation act of 1906, stated, "Those who do much medicolegal work are constantly coming across cases of strong, healthy, able-bodied people who are absolutely well and fit for work and are not suffering from any pathological condition, have become self-centered and, having a lively appreciation of the supposed benefits of receiving money which they do not earn, have become victims of the operation of the workmen's compensation act and other acts conferring benefits in the event of illness or injury."[2] To this Ellis adds that during the decade following 1910, when various compensation acts were passed in the various states, the American surgeon's "first reaction was one of consternation at the vast increase in neurosis and malingering following the application of these statutes. It is a surprise to most of us that many workmen are willing to go for indefinite periods without going back to work except after strenuous efforts by the insurance carrier, the employer and the physician in charge to return them to remunerative employment."[3] In some of these cases there exists a real fear on the part of the injured employe that he has sustained a permanent injury which may later throw him out of employment, thus leaving himself and dependents helpless. In others there is the attitude to exact the last penny of compensation due them.

3. Out and out malingering is probably not common. The detection of fraud in these chronic low back cases is at times most difficult, and may tax the ingenuity of the examiner to the utmost. In many cases where fraud is suspected, it may be more properly the province of the insurance carrier or employer to detect it. It is obviously not the function of the doctor to trace these persons with a movie camera or observe their actions through a hole in the ceiling.

Lesser or milder degrees of malingering are probably quite common. In these the sore back lasts as long as it can be made to last or until better weather or working conditions arrive or the labor market improves. These patients can usually be returned to employment by straight talking.

Disability

FAILURE of the acutely traumatized lower back to recover as expected may be due to various causes:

1. The injuries may have been more serious than suspected, more than simple strains or sprains. Tears of the larger muscles and ligamentous structures require more fixation and a longer time to heal. Slight fractures into joints or injury to joint structures which permanently alter the function of the joint may cause more or less permanent disability.

2. There may have existed weaknesses and instabilities in the back at the time of the accident which, up to that time, were unsuspected and unfelt. Frequently treatment directed to these will hasten recovery from what was actually a trivial accident. Opinion may be divided as to the importance or unimportance of certain congenital anomalies and whether they represent sources of strength of weakness in the lower back.

3. There may have existed disease prior to the accident, or disease may have developed after and possibly as a result of the accident and injuries in question. Where tuberculosis, severe infection, malignancy, etc., are in question, early x-ray and subsequent interval x-ray examinations, careful general examinations and careful attention to the time element are most important. The so-called hypertrophic changes in the spine, when slight or moderate, should not be accorded undue importance. When these changes are marked, they undoubtedly of themselves are a cause of stiffness, pain and disability, and represent backs which are more easily injured and when injured are slow to recover.

4. There may have existed defects inherent in the make-up of the individual. In these it is especially important to recognize a neurotic background, and events and factors which have led to the prolonged disability. Many of these individuals have been started off on the wrong foot by an unsympathetic employer or doctor, in which the accident and resulting injury are unduly minimized and undertreated. Overemphasis of the seriousness of the injury and early overtreatment may be worse. An awareness on the part of these individuals of the presence of an otherwise relatively harmless fracture, existence of congenital anomalies and weakness or the presence of mild hypertrophic changes in the spine, may make further treatment most difficult.

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evaluating damage done to the low back structures by injury, and the parts played by other contributing factors in causing persistent disability, will depend one's ability to institute proper treatment, and, when called on, to reasonably estimate the extent and permanency of disability. Conclusions and opinions based upon subjective complaints of low back pain only, are of no more value in these cases than they are in others.

The careful consideration of each individual case and careful evaluation of objective findings should, in most cases, lead to a fair appreciation of the extent of existing disability. Divergency of estimates in a given case ranging from 10% by one to 90% or more by another, before courts and compensation hearings, are humiliating enough to those concerned.

To be asked to scale up or scale down from these positions in a compromise is worse still.

Treatment

FROM what has been said it is obvious that the treatment immediately following every low back injury is most important. Complete bed rest for one to three weeks, with the lower back in a suitable position for comfort, is the first requisite in most cases. To this, where necessary, may be added extension to the lower extremities and the local application heat and massage. Some form of fixation may be required for a shorter or longer period of time. Just as important as the period of rest immediately following low back injuries is the early return to gradually increasing use of the back. Some injuries may require a longer period of protection, and in some recovery is hastened by systematic physiotherapy over some weeks or months. Routine and daily habit-forming office treatments may be detrimental rather than helpful. Early return to some form of suitable employment, while the patient is still under medical supervision and such treatment as may be necessary, reassures the patient and makes for more rapid covery.

For this the employer's cooperation, which is necessary, is too often not obtained.

Severe injuries and complicating conditions and diseases, of course, require appropriate treatment. Where responsibility for treatment of these cases is assumed, it should be carried out in a sympathetic and painstaking manner, and should not stop short of giving the patient the benefit of any form of treatment likely to bring relief. In those cases in which a more radical form of treatment is indicated, such treatment should be offered the patient. From what has been said so far, it is obvious that the selection of cases for surgical treatment (fusion operations, fasciotomy, etc.) must be made with the greatest care. While such surgical procedures in the average "non-compensation" case is generally satisfactory, similar procedures carried out on many of these individuals which make up the low back problem, end unsatisfactorily. It is therefore not at all surprising that insurance companies are loath to authorize some of these more radical surgical procedures.

Conclusion

IN CONCLUSION, the writer would especially emphasize the following points:

1. The importance of recognizing in every acutely traumatized back the possibility of the so-called low back problem and the confusion often attending the recognition and treatment of these injuries.
2. The importance of careful and thorough examination of each case.
3. The careful and painstaking correlation of all findings.
4. The sympathetic handling of these patients from the very beginning, neither minimizing nor exaggerating injury, neither over- nor under-treating them until they are returned to their former employment.

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Injection Treatment of Hernia

THE recent wave of enthusiasm over the injection method of hernia had its impetus in the successes of sclerotherapy in varicose veins and hemorrhoids.* Some disappointment with the results of surgical procedures, particularly in cases of direct inguinal hernia, was an additional reason for the revival of a method long relinquished and tainted by quackery.

According to recent reports by Bratrud, Rice, Harris and White, and Fowler the rationale of the treatment depends on the property of mildly irritant solutions to produce a fibrosis when injected into normal tissues, and on the ability of the fibrosis thus produced to obliterate the inguinal canal by causing an intimate adherence of the muscular layers in this region by much the same mechanism as that obtained by suturing. Harris and White[1] injected such irritants into the muscles of the thigh in a group of normal guinea pigs. They found that these solutions provoked a polymorphonuclear leukocytic response of short duration, followed by a gradually increasing reaction from the mononuclear mesenchymal elements, which later differentiated into spindle cell fibroblasts, resulting in fibrosis. Macmillan and Cunningham, Fowler, Rice and others have obtained similar results. Rice[2] has obtained microscopic proof of the occurrence of fibrosis in human beings in biopsies from patients who have been operated on for the cure of hernia after having submitted to one or two injections at varying intervals before the operation was performed.

The injection method, according to its modern advocates, is applicable only to hernias that can be completely reduced and kept reduced by means of a truss. Its use is contra-indicated in irreducible hernias, in sliding hernias and in the presence of an undescended testis. Injections are further contra-indicated in the presence of superficial skin infections or erosions caused by the truss, in syphilis, diabetes, senility or marked emaciation. Hernias with a wide ring are not likely to give a good result. A *conditio sine qua non* is a properly applied truss capable of keeping abdominal contents out of the sac at all times. This is frequently impossible in obese patients and in nervous and restless children. The case best suited for the treatment is the small, reducible, indirect inguinal hernia in a young person. The complicated hernias and the large hernias of the middle aged and the elderly are the least suited for the injection treatment. Anatomic conditions in a direct hernia, in the umbilical and the femoral hernia, make the injection treatment undesirable, in the opinion of many.[3]

The treatment as outlined by Harris and White consists of (1) from eight to 12 preliminary injections in a period of one month, (2) four reinforcing injections once a week to consume another month, (3) immediate follow-up examinations once a month for six months (if necessary, occasional reinforcing injections may be made) and (4) final follow-up examinations every two months for one year. The entire treatment requires 20 months for each case. The following are possible complications: an unusually severe local reaction, strangulation, perforation of the bowel, fecal fistula, peritonitis, abscess, atrophy of the testicle, sexual impotence. The needle may enter a vein or artery. The fluid may be placed too deeply or too superficially. If placed too deeply, it may enter the cord or peritoneal cavity. Injection of the cord results in edema of the penis, scrotum and epididymis. Such swellings are not uncommon with this method. A certain amount of pain and transient swelling occur, according to Harris and White with almost every case. The injection of the fluid into the peritoneal cavity produces an attack characterized by an initial chill and severe abdominal cramps, pain of extraordinary severity in both testes and in the penis, leading to shock. Harris and White state that the fitting and care of trusses require a number of days and careful examination. The treatments

* Editorial, in *J.A.M.A.*, October 30, 1937.

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themselves are exacting and require skill.

The numerous possibilities for dangers and complications make continuous vigilance necessary. "Even in the hands of competent men, this method may be found unsatisfactory for these reasons."[1] Harris and White report a recurrence of 4.1% in a follow-up study of 121 completed "good surgical risk" cases of inguinal hernia. In 41 cases of inguinal hernia considered a poor surgical risk, their recurrence rate amounted to 19.5%. MacKinney, in a follow-up study of 300 cases, found 83% cured after six months to three and one-half years. Rice reported 97.6% cured out of 379 patients after not less than six months. Bratrud, at the University of Minnesota Hospital Clinic, had only nine cases out of a total of 707 in which "final closure could not be obtained" but states "I shall be very well pleased if we can keep our recurrences below 10%."

The statement that the treatment has no fatalities is misleading and unwarranted. Bratrud[5] mentions a case in which 16 minims (1 cc.) of phenol-thuja solution had been injected into the peritoneal cavity, causing perforation of the ilium and death. Collins[6] observed two fatal cases of pulmonary embolism, a secondary gangrene of the sigmoid and upper rectum, and two complete bowel obstructions resulting from accidental escape of some of the fluid into the peritoneal cavity. Zieman and Larkowski[7] report a case of necrosis of the cord following a single injection of thuja solution.

In striking contrast to the favorable reports of Bratrud, Rice, Harris and White are those of Burdick and Coley[8] reporting from the Hospital for Ruptured and Crippled, in New York. These authors treated 92 hernias in 66 patients by the injection method. Of 56 cases followed up, a definite relapse was noted in 47, or 81.03%.

At present, 11 patients are apparently cured and nine of these are still wearing trusses.

In the face of such disappointing results they have abandoned the treatment.

Rice states that the end results from this method cannot be accurately adjudged at this time because the results do not extend over a period of more than two years. Bratrud expects not less than 10% of recurrences from the more complicated cases. Fowler states: "A frank and truthful answer is that as yet we have but little exact and dependable information as to the recurrence rate of the injection treatment."

Although in the hands of some investigators the results seem to have been good, the complications, the difficulty in selecting suitable cases, and the still uncertain percentage of recurrences would seem to make the method unsuitable except under circumstances in which unusually careful technic and suitable care are possible. Careful follow-up studies for a sufficiently long period will undoubtedly furnish data on which to evaluate it.

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Clinical Aspects of Pneumonoconiosis

THE irritating effects of inhaled dust have been a widely discussed subject in recent years.* The popular interest, not only in professional circles but also among the laity, has forced or is forcing new compensation laws in most of our states. Because of this increasing importance it is necessary for us as physicians to have a thorough knowledge of the subject so as to be able to treat appropriately those unfortunate patients who have a well developed pneumonoconiosis.

This disease has been somewhat confusing because of the numerous terms applied to dust destruction of the lung. The broad term covering all of them is pneumonoconiosis. Such appelations as anthracosis, silicosis, and abestosis refer specifically to the type of offending dust. It happens in some industries, however, that workmen are subjected to a mixture of dusts, and then the term "pneumonoconiosis" is preferable. The normal protection offered by the ciliated epithelium of the trachea and bronchi is sufficient to prevent or delay the development of the disease where the concentration of dust is slight or even moderate. However, should the cilia be damaged by repeated respiratory infections or by irritating gases, then pneumonoconiosis will appear at an earlier period than expected and will be more extensive than under similar conditions.

Dusts may be classified under two groups depending upon their origin, i.e. (1) organic, (2) inorganic. Organic dusts do not cause pulmonary destruction, and only those inorganic dusts that contain silica or silicates can be definitely stated to be offending agents.

So widespread is the use of silica and silicates in industry that one should be familiar with their occurrence. The most important of the silicates is asbestos, and in recent years the asbestos industry has come to realize that it is confronted with its own particular dust hazard. "Asbestosis." The danger is found particularly in the weaving process where the continued inhalation of the dust causes the development of an interstitial fibrosis in the midzone of the lungs. The disease is somewhat milder and does not develop as rapidly as that produced by silica. Silica is of prime importance in the mining of gold, silver, lead, iron, and anthracite coal. These minerals are found in rock containing silica and the rock dust constitutes the hazard. Similarly, quarry workers and those employed in dressing granite and sandstone are equally subject to this hazard. This would include sand blasters and foundry workers where castings are made. For many years it was thought that metal grinders and tool sharpeners developed a pneumonoconiosis because of the metal dust. We now know that it is not the metal dust that does the damage but rather it is the silica dust from the sandstones. Where carborundum wheels are used the hazard very materially decreases or entirely disappears. The manufacture of scouring and abrasive soaps requires silica in a very finely divided state and unless proper prophylactic measures are taken the hazard is serious. Similarly, the manufacture, grinding and polishing of glass may carry with it the serious possibility of pneumonoconiosis.

The factors controlling the development of the disease are few but important. Primarily, the worker must be exposed to a dust that contains more than 10 million particles per cubic foot, and of which the silica content is 35% or more. The conditions in different industries vary, but where the dust contains a high percentage of silica, such as in sand blasting and gold mining, the hazard is extremely high. This factor combined with the length of time to which the worker is exposed constitute the main elements. In the abrasive soap factories the hazard is greater because of the presence of an alkali soap powder that seems to facilitate the chemical change of the silica after it has been inhaled and thus to enhance its destructive effect. In the hard coal industry the average miner will not develop symptoms until after twenty years or more of work. However, if the anthracite miner has used the dry drill than the rock dust (30% silica) which he inhales will cause a third stage of pneumonoconiosis in four or five years. In this connection let me state that the coal dust in itself does not cause any pulmonary destruction but merely pigments the lung. Any fibrosis in a coal miner is due to the contaminating rock dust.

In order to have a clear understanding of the signs, symptoms and prognosis of this disease it is necessary to explain briefly the mechanism whereby the lung is disabled and how eventually it may be completely destroyed. Essentially the disease is a disturbance of the lympatic drainage of the lung due to the formation of scar tissue. The normal lymphatic drainage is inward to the hilum. A small area beneath the visceral pleura is drained into the sub-pleural cistern and from thence along the lobar septa to the hilum. When the dust particle reaches the alveolus it is picked up by alveolar phagocytes called "dust cells" and carried to the nearest lymphatic channel and there the process of lung destruction begins. The tiny dust particle, acted upon by the alkaline body fluids, forms a colloidal silica hydroxide which is a strong protoplasmic poison and by its action causes death of the dust cell and necrosis of the immediate surrounding tissues. A small scar is formed and the lymphatic channel is blocked. Should the dusting be relatively light the action begins principally in the hilus lymph nodes and later in the numerous small lymphoid deposits in the lung. If the dusting is intense the lymph derangement is so acute as to halt most of the dust in the mid-zone of the lung. As the dusting continues these minute areas of destruction (which are replaced by scar tissue) enlarge and we have nodular areas of fibrosis scattered largely in the mid-zone equally in both lungs. In the late stages these nodules coalesce to form massive areas of fibrosis that may ultimately replace 90% of the lung. There are two other points of importance in this picture of pathology. The first is the compensatory emphysema that surrounds each area of fibrosis and which thus masks for the most part any physical signs of these fibrous consolidations in the chest. The other is the strain put upon the right heart by the obliteration in part of the pulmonary vascular bed. This extra work on the right ventricle usually terminates the picture in the last stages of pneumonoconiosis.

There are no characteristic stethescopic findings. In fact the physical examination of the chest is most disappointing. Even where there are large masses of fibrosis present the signs are practically non-existent. This is due to the compensatory emphysema that masks and prevents any exact estimation of the stage of destruction. No reliance must be placed on the physical findings. Clinical symptoms do not occur until the disease is at least moderately advanced. In the later stages we find dyspnea on moderate exertion perhaps combined with a slight unproductive cough. Weakness is prominent in the terminal stages and the dyspnea has now become orthopnea. With such few physical signs and symptoms, how then may the diagnosis be made?

The diagnosis rests upon the combination of a very carefully taken history and the roentgenogram. The history should include a description of the conditions under which the man works, the type of dust to which he is exposed, and an exact statement as to the length of time he has been in this dusty occupation. The interpretation of the roentgenogram requires experience in such work. The pictures readily show the fine nodular areas of the earlier stages in the lung to the large masses in advanced cases. The knowledge derived from the history will enable the roentgenologist to make the diagnosis quite easily.

A discussion of pneumonoconiosis would not be complete without a word as to its relationship with tuberculosis. It is generally accepted that the presence of silicosis predisposes the worker to tuberculous infection. This is particularly true under those conditions where the dust is practically pure silica.

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* Ross K. CHILDERHOSE, M.D., Allenwood, Pennsylvania; Read at the meeting of the American College of Chest Physicians, Atlantic City, N. J., June 7, 1937; Published in *Diseases of the Chest*, November, 1937.

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Amongst the hard coal miners of Pennsylvania this complication is not unduly prominent and the type of tuberculosis developed is one of extreme chronicity. A differential diagnosis is sometimes quite difficult and frequently depends upon a careful and prolonged study of the sputum.

One of the unfortunate features of silicosis is the tendency for the disease to advance even after the man has been removed from his dusty occupation. I have seen the fibrosis continue to increase in many miners long after they had given up mining. The proper treatment, therefore, for this condition is prevention. The application of suction devices to remove dust from its source has proven to be the most effective. Small face masks containing sponges are worse than useless because of their lack of protection and the false sense of security that they engender. After the disease is advanced the worker should, of course, be removed from his occupation and given a thorough bed-rest so as to relieve the right heart and increase the cardiac reserve. The course of the disease should be followed at all times by frequent roentgenograms.

The Importance of Urinalysis

PROPER examination of the urine derives its great practical importance from the fact that through it we obtain not only an index of various changes which may be occurring in the kidney or in the genito-urinary organs, but because in the urine we also find the evidences of changed body chemistry as incident to poisoning of various sorts and the different diseases like the "metabolic disorders" which accompany improper utilization of proteins, of carbohydrates, or of fats in the body.* From the fact that these numerous and widely varying changes in all or a part of the human mechanism may thus mirror themselves in the physical or chemical properties of the urine there arises the difficulty of judging properly the real significance of any given urinary findings.

The physiological and mechanical disturbances producing evidence of an abnormal urinalysis will also be discussed in this paper for this reason. The technician reports sugar in the specimen of a pregnant woman. She should not be treated as a diabetic when anything but a restricted diet should be her share. The trace of sugar was possibly due to milk sugar or perhaps she has been taking some formaldehyde producing drug such as urotropin or aspirin, under such circumstances our urinalysis becomes meaningless if we do not have a positive knowledge of our patient's physical condition and daily habits.

* N. B. Ellis, M.D., Wilson, Arkansas; Read before the First Councilor District Medical Society, Tyronza, June 18, 1936; published in *J. Arkansas Med. Soc.*, October, 1937.

Since the 24-hour period is the unit cycle of our physiological existence, it is for most purposes the best unit time to choose for an examination of the quantitative and qualitative output of urine. Shorter periods, because they do not cover the daily habit of the human machine as regards work and rest, feeding, etc., are likely to be fallacious. There are, however, some important exceptions to this rule. Whenever, certain changes are more intense at one period in the day than at another a special examination at such time will give light where the examination of the 24-hour sample may have failed. Traces of sugar in a mild diabetic are most easily found an hour or two after partaking of a meal containing carbohydrates. Traces of albumin in the ordinary nephritic are most common in specimens obtained before breakfast. On the other hand, in the orthastatic of physiological albuminurias, such traces are found in specimens voided when the patient has been up and about and through exercise has raised the acid content of the urine above the average or even night level. To obtain a 24-hour sample some hour of the day should be settled upon. Have the patient void naturally or be catheterized and discard this urine. All subsequent voidings are then collected in clean vessels. The last voiding being timed to coincide with the hour at which the 24-hour period was started.

Urine should not be preserved, but be examined as fresh as possible. A few minutes or a few hours may bring about changes in urine which will so disturb the value of a whole series of tests as to make them meaningless. Urine from an infected genito-urinary tract may through ammonical decomposition, for example, give false readings as to acidity, urea content, presence of casts and nature of original sediment. If the urine must be preserved, cold storage is least harmful and will do much to prevent bacterial contamination. Drug preservatives may be used but they have their objections also. For instance, formaldehyde, five or 10 drops to the pint may be used, but a positive sugar test would be without value.

Urine is a complex of water and dissolved substances, the secretion of which is largely independent.

The secretion of water by the kidney is in essence its first function, for without such water secretion, no dissolved substances of any kind can be excreted. A good water output by the kidney is therefore the best evidence of its functional capacity. The secretion of dissolved substances is secondary to this. This holds not only for the normal substances appearing in the urine, as sodium chloride and urea, but even for all foreign substances as dye used in functional kidney testing. In other words a kidney incapable of excreting water properly will never be able to properly excrete any of these dissolved substances. On the other hand a kidney may function normally and yet not properly excrete various dissolved substances. To make sure that judgment regarding a given output it not fallacious, the following physiological conditions must be borne in mind: Under physiological conditions water is taken into the body, in the case of the human being, only through the mouth, not only as water and other fluids, but as large quantities in the food, or as subsequently formed in the tissues through the oxidation of hydrogen-containing foods such as carbohydrates and fats to water. Water may, however, get into a patient by other means, namely, enemas or drips, or from the serous cavities. The water from any or all such places is absorbed into the blood and carried to different tissues of the body. Only a part, and this not the major part, is lost through the kidney. This fact is often forgotten by the physician and all manner of erroneous conclusions follow.

Water may be lost from the body through the lungs, the skin, the kidneys, and the bowels. Loss of water through the bowels may be ignored if there is no diarrhea or if cathartics have not been administered to cause loss of water. For the rest, the amount of water lost through the kidneys is dependent upon the absolute amount of free water available for excretion minus the amounts lost through the lungs and skin. For comparison, from the lungs is ordinarily lost as much or more, 63 ounces of water; and the skin pours out one-fourth to one-half as much as the kidneys, 17 to 25 ounces. The remainder from all water taken in or formed in the body goes out through the kidneys, 51 to 61 ounces.

Other things remaining constant, less urine will be lost through the kidneys if the activity of the lungs or skin is increased, and vice-versa. For this reason a hot day decreases, and a cold day increases, the urinary output in normal individuals. In the sick a fall in amount of urine after the successful sweating of a patient is to be expected. The secretion of 1500 cc. or more of water by the kidneys in 24 hours justifies the conclusion that they are possessed of an adequate functional capacity. It has been proven from animal experimentation that one-eighth of the total kidney substance properly preserved will maintain all normal kidney secretion. So far as functional tests are concerned, the secretion of amounts of urine below 1500 cc. in 24 hours requires investigation, but amounts as low as 500 cc. may not mean functional incapacity of a kidney. To see if the kidneys are really at fault, give one quart of water, if the urinary output jumps up 200 cc. to 500 cc. during the next two hours the kidneys are not at fault. If the secretion remains low, a second quart of water may be given at the end of two hours. If the water output does not then rise, the kidney efficiency for either direct causes, as in generalized parenchymatous nephritis, or indirect causes, as in a decompensated heart with bad circulation, may definitely be considered below par.

Urine is of a pale yellow color because of a pigment which it contains. The amount of this pigment formed in 24 hours is fairly constant, but the increase of the color goes up or down with every increase or decrease in water excretion.

The odor of normal urine is familiar to most individuals. Acetone can sometimes be smelled in the urine. Since its presence is of great importance from a diagnostic, prognostic and therapeutic point of view, it is well to make a mental note of such a finding. The smell of ammonia in the freshly voided urine indicates decomposition of the urea and is due usually to infection of the urinary passages or of the urine itself after voiding. Freshly voided urine when normal is usually clear. This is usually true in the 24-hour mixed specimen. Individual samples after meals when much acid is being poured into the stomach may be turbid. This is because the urine at this time tends to become more alkaline and so various phosphates are precipitated. Upon the addition of acetic acid the turbidity clears if due to phosphates. Even normal urine may become cloudy if chilled.

Specific gravity determinations are usually made on the 24-hour specimen of urine. For this purpose a urinometer is used. Under normal conditions the specific gravity of the 24-hour mixed sample of urine will vary between 1.010 and 1.025, not only from day to day, but also from hour to hour in the same day. In alleged pathological conditions, the extremes may run from 1.002 to 1.060. Specific gravity determination upon the urine while readily made probably more often leads the physician to false conclusions than to correct ones; this is because it is too largely forgotten what physiological facts control the amount of material dissolved in the water of urine. It is in the urine that certain ultimate products of body chemistry are thrown off, plus those elements of diet which are not used in the elaboration of heat or other types of energy in the body, namely, the ash or salts taken in with our food. It is to the presence of this urea and the various salts that urine owes the fact that its specific gravity exceeds that of distilled water, or 1.000. Conversely, the specific gravity may be used to calculate the total solids in the unit volume. For this purpose the figures of the second and third decimal points are multiplied by 2.33 (Haeser's coefficient), the answer given being the amount of solids in grams per liter. The amount of solids lost in the urine is dependent primarily upon the total food intake, for it is this which determines not only how much of various salts and urea may be pro-

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duced in the body and lost through the urine, the bowel or the skin. Other things being equal, a low specific gravity or low total solid output merely means that the patient is not eating enough. Habit in water drinking may by itself be sufficient to yield a large daily output of urine with low specific gravity. Not only heavy water drinkers, but heavy drinkers of coffee, tea or beer come in this class. It would be absurd in such persons and on such evidence alone to think their kidneys affected. Cold weather with decrease in water loss by way of the skin and lung increase the water output by the kidney. Wherefore, the specific gravity of the urine in cold weather is uniformly lower than in warm weather. If a better circulation through the kidneys and a poorer one through the skin and lungs is brought about by a psychic state, as in fear or hysteria, the result is again the same, more water voided as urine and this is also of low specific gravity. Such facts will suffice to show why even when the secretion of much urine of low specific gravity is persistent, it need not yet mean chronic interstitial nephritis. When the latter diagnosis seems justified because of high blood pressure, cardiac hypertrophy and occasional casts with a little albumin confirm our suspicions, it must still be clearly kept in mind that such high secretion of water is an index of good kidney function and that if the total solid output corresponds with the intake, everything is to be looked upon as favorable so far as the kidneys are concerned. Summed up, we may therefore say that if the diet is not properly considered, all specific gravity measurements are worthless.

Acid determinations are usually made by the rural physician with litmus paper. Litmus rarely shows an alkaline reaction if ammonical decomposition of the urine is not present unless an alkali is being fed to the patient. The acids found in urine are normal physiological products of body chemistry. In part some are abnormal. Under the first heading comes phosphoric and sulphuric acids formed from phosphorus and sulphur contained in a protein or meat diet. Thus a high protein or meat diet will give you a normally high acid urine. The usually mixed diet of man, i. e., meat, vegetables, fruits and milk, usually yield a urine slightly acid, but should a vegetable and milk diet be substituted an overflow of alkalis may so far exceed the production of acid that urine distinctly alkaline in reaction may be voided throughout the 24 hour period.

The abnormal acids or acetone bodies, lactic acid, beta-oxybutyric and diacetic acid, are found. We have already found out that we can reduce phosphorus and sulphuric acidity by reducing the meat diet. Lactic acid being caused by oxygen starvation may also be reduced by improving the supply of oxygen. It is for these reasons that we order fresh air for the anemic, bed rest for the cardiac patient, and antidotes for poison cases. Beta-oxybuturic and diacetic acid are products of carbohydrate starvation or an excessive amount of fat in the diet. We can only inhibit the formation of these acids by improving the carbohydrate utilization and cutting out the fats. Sometimes it is not possible to do as much in this direction as we wish, as in severe diabetes. Proper utilization of carbohydrates fails in a large number of individuals who are in no sense diabetics but are ill in other directions, such as colitis in children, pernicious vomiting in pregnancy, or typhoid fever in the adult. Sugar starvation, moreover is induced

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in a large number of patients by bad feeding and since a patient is just as dead if starved to death through bad feedings as he is if he dies from diabefes, the recognition of carbohydrate starvation is of paramount importance. Let me then implore you when in doubt as to which you shall give your patient, normal saline or glucose, take a few drops of ferric chloride, test the patient's urine, and if acetone bodies are present then by all means give glucose. The difference may mean that between life and death itself, the one exception being diabetes.

Sugar or reducing substances in the urine is a subject for a paper in itself, and will not be discussed at this time.

Albuminuria or proteins in the urine is another subject of vital importance to the patient and the doctor. Of the subject I only want to mention the origin of albumin because this one phrase "your urine contains albumin" has been the cause of a great deal of worry and inconvenience by patients, physically and financially without just cause for same. First, the patient believes that he will soon come to the end of his days by the much dreaded disease known to the laity as Bright's disease. Therefore, to prolong his life he tries a rigid diet, changes his trade or perhaps tries a new climate and better water in his search for health. Financially, he is forever barred from obtaining insurance, or, at least, he is rated in age or amount of premium to such an extent that he feels that it is impossible for him properly to protect his family.

The physician, before telling his patient that he has albumin in his urine and that it will be necessary for him to diet, rest and take medicine, should make sure that the albumin contained in the specimen examined did not come from a lesion outside the kidney itself. You can determine this fact only by making a microscopical test of an acid urine and if you find casts you may be reasonably sure that the albumin comes from the parenchyma of the kidney.

Casts could be discussed at length if time permitted, but I want to call your attention to a personal observation in the study of casts. It is well known that you cannot make a diagnosis of any given kidney lesion by the type of casts present in the urine, but it has been my experience in treating wasting diseases like pneumonia, typhoid fever, neglected cases of malaria, colitis, etc., if you have found only an occasional cast of various kinds during the course of the disease and as the patient approaches the crisis or begins to convalesce, the urine is suddenly found full of small and large granular casts, the prognosis is death.

The Treatment of Burns

THIS paper deals chiefly with the modern treatment of burns, thus in so brief a paper it will be impossible to go into detail concerning the physiology, chemistry and pathology of this condition.* It is necessary, however, to have some general understanding as to the etiology of the toxemia in this condition in order to give a rational form of treatment.

The literature for many years has been full of controversy over this question, but Aldrich[1], in 1933, was the first to suggest infection as being the cause of toxemia in burns. Aldrich based his theory on careful bacteriological study of burned patients, making cultures on the burned areas from the time of admission until areas were healed. He found the wounds to be sterile during the first 12 hours but that after 12 hours had elapsed, culture showed mixed infection, and in 48 to 56 hours, pure cultures of streptococcus could be obtained. The period of toxemia with the usual symptoms of restlessness, nausea, pain and elevation of temperature begins from the fifteenth to eighteenth hour and Aldrich found that this syndrome ran right along with the beginning of infection as shown by his studies.

When one stops to consider this he is in somewhat of a quandary as to why we should become alarmed about broken down proteins when we have something as concrete as bacterial infection as an etiological factor in the toxemia of burns. If a burn is toxic because of infection, then why should we not treat it as such, rather than by applying lard, grease, wax or some other similar concoction which helps to form a good culture medium for infection instead of combating it.

The initial shock in burns is an entity within itself and similar to any other surgical shock. The treatment for shock should be initiated as soon as the patient is seen regardless of what form of therapy is to be used on the burned area. This treatment consists of large amounts of fluid, chiefly saline, glucose, or whole blood. Probably the best form of fluid is whole blood, but saline or glucose will suffice if given in sufficient amounts to maintain or restore the blood pressure level. Sedatives and warmth are also necessary adjuncts to fluid in the treatment of early shock. Burned patients usually either rally from the shock within a few hours or become moribund, and when they have rallied, then burn therapy may be instituted.

The general treatment of burns should consist of a high vitamin and high caloric diet, and fluid intake should be at least 3500-4000 cc. a day. Regardless of what form of specific treatment is used, it is necessary to keep the patient warm and this can best be done by the use of a heat cradle. The severity of the burn determines the type of treatment which should be used. Calamine lotion is very soothing to first degree burns and is usually all that is necessary, as this group includes only the cases with skin erythema, such as sunburn. In minor second and third degree cases, a mixture of radolatum oil, butesin picrate or gentian violet jelly give good results, but are not adequate for severe cases. In severe second and third degree burns there are three methods of treatment which I consider worthy of mention, namely: tannic acid, gentian violet and hypertonic saline baths.

Tannic acid has received a great deal of recognition within the past year, although it was developed by Davidson[2] in 1925. Davidson advocates the use of a 2½ to 5% solution of freshly prepared tannic acid applied every 20 minutes until an eschar is formed. It may be applied either as a spray or with gauze compresses saturated with the solution. The advantages of this form of treatment are that tannic acid is soothing to the burned area, is slightly germicidal, prevents loss of fluid, and tends to minimize infection by sealing over a sterile field. The disadvantages are that the eschar is brittle and tends to crack; it tends to masque underlying infection, and probably destroys the minute islands of unburned epithelium.

Gentian violet was first advocated by Aldrich in 1933 and has merits which demand mention. The burned area is sprayed with a 1% aqueous solution of gentian violet every two hours until an eschar is formed and thereafter every four to six hours as needed. When infection begins the eschar will soften and it is then necessary to pick the soft area off and re-apply the solution until a new eschar has formed. The advantages of gentian violet are that it is soothing, is germicidal, and if watched closely the patient will not have as toxic a convalescence as with tannic acid. The disadvantages are that it stains the bed linen, requires absolutely relentless supervision, and is consequently not very practicable for the general practitioner.

The hypertonic saline bath treatment of burns was first advocated by Blair, et al., in 1932 and consists of a tried and tested method of combating infection by using hot soaks or compresses. The technique consists of placing the burned patient in a tub of warm salt solution two or three times daily and allowing him to remain in the tub from 45 minutes to one hour at each sitting. The solution is made up in the tub and should be made to about a 3 to 5% strength in ordinary unsterile tap water. It is advisable to give a sedative prior to the first two or three baths, but after that the patient undergoes no discomfort whatsoever. When out of the bath, he is kept in bed without dressings, under a warm tent heated by electric light globes. Where the burn involves the face it is advisable to use normal saline compresses over this area and the tub baths may be instituted for the rest of the body. This form of treatment does not completely eliminate

* G. H. McSwain, M.D., Arcadia, Florida; Read at the regular monthly meeting of DeSoto-Hardee-Highlands County Medical Society, Wauchula, November 10, 1936; published in *J. Florida M. A.*, September, 1937.

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infection but the infection is held in check at all times and the patient does not run an extremely toxic course, as is the case in most forms of treatment.

Regardless of which form of treatment is used the patient should be watched carefully and treatment should be under the physician's personal supervision. Frequent blood counts are important as I have seen two burned patients die of agranulocytosis, which no doubt was a result of the severe infection, and it may be justly assumed that there have been more deaths from this complication than we suspect. The sedimentation rate is very helpful in checking the onset and degree of infection. It is possible, by means of this simple test, to predict a rise in temperature at least 12 hours prior to its onset.

In conclusion, I wish to emphasize the point that we need not trouble ourselves about the hypothetical theories of burn toxemia when we have a basis for toxemia as concrete as infection. Why not treat a burn as though it were an infected wound and not some freak condition that baffles the philosophers?

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Hygiene in the Small Factory

OCCUPATIONAL diseases are the product of improper industrial hygiene.* Those industrial plants freed from harmful exposures will be confronted with no actual cases of occupational diseases produced by their own work conditions. Conversely, in those industrial plants where industrial hygienic conditions are at a low ebb, occupational diseases are prone to arise, although this occurrence is not inevitable.

NUMBER OF SMALL PLANTS: Industrial America is dominated by small plants. Among those establishments reporting an annual output valued at $5,000 or more, 95,767 have five or fewer wage earners. More than 98% of all plants throughout the country employ less than 500 workmen.

DISEASES IN SMALL PLANTS: In terms of percentage of the total number of workers employed, much higher numbers of occupational diseases originate in petty industrial plants. The reason is obvious. Work conditions from the hygienic aspects are far more likely to be objectionable than those found in plants employing 1,000 or more persons. Faulty thinking erroneously associates outstanding injurious exposures in industry only with gigantic plants—large mining operations, steel mills, automobile manufacturing, heavy chemical production. In this country there are hundreds of mines employing no more than five workmen, thousands of garages carrying out activities on automobiles closely related to the operations of automobile manufacturing, petty chemical plants in large numbers utilizing the same materials found in heavy chemical manufacturing.

Readily it will be recognized that in a very large manufacturing establishment, such as an automobile corporation, where more than 100,000 workmen may be employed, the work problem is only to a small extent peculiar to that particular industry.

The harmful exposures that might be encountered in such an automo-

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* CAREY P. MCCORD, M.D., and HERBERT T. WALWORTH, M.S., Bureau of Industrial Hygiene, Department of Health, Detroit, in *Safety Engineering*, October, 1937.

bile department as upholstering are no whit different from those that might be detected in a detached upholstering factory, operating as an industrial entity. Although exposures which may lead to occupational diseases are the same for the large scale manufacturer and the small, in the small plant these exposures are much more likely to constitute practical dangers, due to the absence of an equal degree of protective measures as is true for the large plant. Throughout the land there may be found in varying degrees of industrial application no less than 2,000 different substances or conditions capable of inducing affections characterized as occupational diseases. With scant exceptions, every one of these substances or conditions may be encountered in work places where no more than 100 persons are employed.

FREQUENCY IN SMALL PLANTS: There are sound economic reasons which prevent many small plants from maintaining medical departments, safety engineers, industrial hygienists, or elaborate installations such as air conditioning, for the comfort and protection of workmen.

A further factor contributing to the greater number of occupational diseases in small plants is associated with larger numbers of older men working in small plants. Under present conditions of widespread unionism and seniority rights, it will come about in a few years that average ages will be appreciably increased in large plants.

Occupational diseases attack older workers in many instances more readily than younger ones engaged in the same tasks. The bodies of these older workers house the accumulated ill effects of many years of activities, probably in many employments.

INDUSTRIAL EXPOSURES: The exposures of industry, whether large or small, are to be found in dusts, vapors, gases, smokes, mists, liquids, noises, vibrations, heat, cold, chemical rays, sensitizing agents, postural abnormalities, etc. To detect and measure these exposures requires the services of the industrial hygienist. The design and installation of mechanical protective devices call for the services of the engineer. The cost of both personnel and material necessarily represents an outlay of money reflected in a high per capita cost for adequate installations and personnel.

ROADS TO IMPROVEMENT: A valuable service will be rendered if some suggestions may be made toward the eradication or control of work conditions which lead to these occupational diseases.

1. The large plant is much more likely to be aware of the importance of hygiene and to eliminate undesirable hygienic conditions through its own personnel. On the whole, the small plant is less likely to recognize this need for bettered work conditions. On this account, Federal, municipal and state departments of health should have industrial hygiene facilities for extensive cooperation particularly designed to meet the needs of the small plant.

At the present time, no less than 25 states maintain bureaus proffering some industrial hygienic services. All other industrial states should be called upon by industry itself to establish and equip bureaus with personnel and apparatus in order to safeguard industrial workers. For every occupational disease cause there is some protective measure which will render this cause incapable of carrying out its injurious action on the bodies and minds of industrial workers.

2. Many types of helpful guidance and services should be derived from the insurance carrier. Definitely it is to the interest of the insurance carrier to reduce to a minimum all possible sources of injury to workmen. The greater number of companies providing compensation insurance now maintain laboratories and personnel for cooperation with industrial establishments. One of their outstanding opportunities is to render a full measure of hygienic services especially designed for the small plant.

3. One of the great needs is that manufacturers of protective appliances necessary to industrial hygiene work, design and market simple and inexpensive equipment suited to the requirements of the small plant. Further, these manufacturers would do well to have trained representatives visit the small industrial plant and carry education programs to preserve the health of the worker.

4. A definite opportunity exists for continuous educational activities by magazines such as *Safety Engineering* and others in related fields, all directed to the qualifying of the small industrialist in hygiene, occupational diseases, safety, compensation, insurance, physical examinations, etc.

5. That small plant will maintain the best conditions and be freest from the causes of occupational diseases in which the management itself becomes qualified to recognize its own deficiencies and to procure suitable remedies.

6. Granting that the small industrialist is ordinarily not warranted in maintaining full time medical services on his premises, the plea is made for the cooperation of several small plants closely situated geographically to procure medical services of a qualified physician who may take care of not only medical problems of the several plants, but also serve as the industrial hygienist and for each plant.

SUMMARY: Finally, it is to be emphasized that the total number of injurious agents used in industry is yearly increasing. Of greater significance, the total number of claims being made upon employers is at this very time increasing far out of proportion to these new exposures. In some states the upward trend in claims filed during this year may lead to numbers double that for any preceding year. Industry, whether large or small, must face the increased responsibility for protection against occupational diseases.

The Treatment of Pneumoconiosis

PNEUMOCONIOSIS is a fibrosis of the lung due to prolonged exposure to and inhalation of inorganic dust.* It is an industrial disease occurring among hardrock miners, sand blasters, stone cutters, lens grinders, and among those others whose occupations expose them to inorganic dusts.

Chief of the inorganic dusts as causes of disability are those containing silica. It was originally claimed that "free" silica, in the form of quartz, alone was capable of producing such fibrosis, but more recently asbestos (a silicate of magnesium) has been found to cause a pulmonary fibrosis that is diffuse and not nodular, as is that due to "free" silica. W. R. Jones[1] found a fibrous silicate of aluminum and potassium called sericite in association with the quartz where pneumonconiosis was found, and that there was no such tissue changes in its absence. More recent work in this country indicates, however, that silicosis can be detected in those handling pure quartz.

Anthracosis, siderosis, lithosis or chalicosis, "miners' phthisis," "miners' consumption," "miners' asthma," "masons' phthisis," "potters' asthma," etc., are terms that are either incorrectly used to describe pneumoconiosis due to silica, or relics of the time when pneumoconiosis was not clearly defined. Inhalation of coal, iron, aluminum, and other inorganic dusts does not cause the fibrosis that results from inhalation of silica. They, like other minute foreign bodies, are carried to the bronchial lymph nodes and cause little if any damage to the lung. Their inhalation does not seem to be associated with a high incidence of tuberculosis; in fact, there is some evidence that inhalation of pure carbon or coal dust may result in a lowered incidence of that disease. However, silica-containing dusts are often met with in the mining of coal, iron, and other inorganic matter, so that workers in such mines develop a pneumoconiosis that is really due to the silica, though it may be altered somewhat by the presence of the other inorganic dusts.

Pneumoconiosis is, as a rule, a very chronic condition. It may be a cause of disabling illness, especially if complicated by tuberculosis, after only three to five years of exposure to dusts of high concentration, but more commonly does not cause disability

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* N. S. DAVIS, III, A.B., M.D., F.A.C.P., Chicago; in *Clin. Med. & Surg.*, October, 1937.

1. (*J. Chem. Metallurg. & Mining Soc. of South Africa*, 34:1-51, Sept.-Oct., 1933).

TOXICOLOGY • McNALLY

until after 20 to 25 years of exposure. This chronicity of the disease, together with the type of lesions found in the lungs makes effective treatment very difficult.

THE most important factor in the treatment of this disease is its prevention. In this the sanitary engineer must be the closest ally of the industrial physician. Together they must devise ways and means for reducing the exposure to dust so that pneumoconiosis will not arise. No workers in the dusty trades have been found to have significant pulmonary fibrosis when the exposure was to less than five million particles of dust per cubic foot of air. Exposures to less than 20 million particles of dust per cubic foot of air are considered relatively safe. This reduction in dust concentration can be accomplished by isolating the dust-generating process to a confined space, so that only those actually doing the work are exposed. Then the concentration of the dust to which these men are exposed can be reduced by wetting the dust at its source and by the use of exhaust ventilation to remove the dust before it can be inhaled. The use of the exhaust ventilation has the widest application of all methods and is most effective if the equipment is properly designed to fit each problem and is adequately maintained. The use of respirators is not so effective as exhaust ventilation. They are not liked by the workers. Wherever possible, non-dustproducing methods should be substituted. At times harmless substances, such as carborundum, may be substituted in place of the silica-containing abrasives.

The methods outlined above really all belong to the engineer, but the industrial physician also has an important part to play, for silicosis specifically predisposes to infection with the tubercle bacillus, though the mechanism of this action has not been determined.

In 1930, Sir William Bragg described the probable molecular arrangement of freshly fractured quartz, and P. Heffernan suggested that acute silicosis might be due to the unsaturated oxygen atoms present. Sir Frederick Banting and his co-workers suggested that "if the unsaturated oxygen atoms cou'd be satisfied with nascent hydrogen, it might diminish the toxicity of silica in tissue and change a fibrosis response into a simple foreign body reaction." As a result of experimental work, in vitro and with rabbits, they conclude that (1) the addition of small quantities of metallic aluminum dust almost completely inhibits the solubility of siliceous materials in a laboratory beaker; (2) rabbits dusted with quartz to which less than one percent of metallic aluminum dust had been added showed practically no fibrosis, while control rabbits, dusted with quartz alone, showed well-developed silicosis.

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This work, if confirmed and if applicable in the dusty trades, should prove of great value. It must be proved experimentally that this method removes the specific predisposition to infection with the tubercle bacillus. As Gardner believes that this predisposition is due to an alteration of the soil, rather than to changes in the infecting organism, it would seem that rendering the silica inert by satisfying the unsaturated oxygen with nascent hydrogen, would eliminate this factor. Furthermore, such a change in the silica would prevent its causing any changes in the infecting organism.

At least 75% of those who develop silicosis die of tuberculosis, which may appear at any stage of the disease. This combination of tuberculosis and silicosis is, however, not merely a superimposing of one pathologic process upon another, but a new condition. The silicosis seems to alter the tissue making it more susceptible to infection by the *B. tuberculosis*. The resulting condition differs from that found in pure silicosis or in tuberculosis without silicosis. Furthermore, tuberculosis with silicosis is apt to progress more rapidly, has a higher mortality, and is more often found in older individuals than is the uncomplicated phthisis. The infection may be due to the lighting up of an old, quiescent tuberculous process or, more commonly, to a new airborne infection.

The prevention of the silicosis may be chiefly the duty of the sanitary engineer; but the prevention of the tuberculosis is chiefly the duty of the physician. All persons engaged in dusty trades, in which silica is a component of the dust, should be most carefully examined, clinically and roentgenologically, for the presence of active or quiescent tuberculosis.

Those persons having active tuberculosis should not be employed at such work, because the inhalation of silica would aggravate their tuberculosis and because they might spread the disease to some who already had silicosis. Individuals who are found to have a history or scars of recent tuberculosis should be eliminated from such trades, as the inhalation of silica may activate their tuberculosis. Because of the specific predisposition to tuberculosis possessed by those affected with silicosis, regardless of their age, no one continually exposed to an open case of tuberculosis (that is, no one living in the same house or apartment with an open case of tuberculosis) should be subjected to inhalations of silica-containing dusts. Employees of restaurants in which those having silicosis eat regularly should, in addition to the members of their families and those with whom they live, be examined for tuberculosis. Open cases should be removed, so as to eliminate them as possible sources of infection.

This isolation of those with silicosis from those with active tuberculosis is one of the most important preventive measures before the medical profession. It is complicated by the fact that, in those communities in which many of the workers are engaged in a trade in which there is exposure to silica dust, the incidence of tuberculosis is already high. Furthermore, the economic conditions in such communities may be such that, without the help of the employer (often a non-resident) or the State, an adequate tuberculosis survey of the whole community, in addition to a silicosis survey of those exposed to the dust, can not be made. Moreover these communities may not be able to support the sanatoriums needed for the proper care of the open cases of tuberculosis, with or without silicosis.

Do not send to a tuberculosis hospital or sanatorium an individual who has silicosis without tuberculosis, for in such an institution he is almost certain to become infected.

The treatment of the silicosis with tuberculosis is the same as that for tuberculosis alone. The combination is, however, a more grave disease and usually runs a rather rapid course. Treatment is much less effective than in the uncomplicated cases of tuberculosis. Certain types of therapy, such as pneumothorax, are contraindicated, because the tuberculous infection is usually bilateral and because of the extensive fibrosis present in both lungs.

In the simple, uncomplicated case of pneumoconiosis, due to inhalation of silica-containing dust, there is little disability until late in the disease. However, as soon as a diagnosis of silicosis is made, the exposure to silica dust should be stopped. Even so, symptoms may develop years later. At any stage of the disease, nothing can be done to remove its cause from the system or arrest its progress. Treatment is, therefore, symptomatic. It must be directed at the associated bronchitis, bronchiectasis, fibrosis, and heart failure. The prevention of acute respiratory tract infections is especially important in those with silicosis as, next to tuberculosis, the most common cause of death is pneumonia. Chronic respiratory tract infection, sinusitis, tonsillitis, etc., must also be eliminated in so far as possible, as these conditions are frequently the cause of chronic bronchitis and bronchiectasis.

As there is, in advanced cases of silicosis, an extensive pulmonary fibrosis and, because the lymphatics accompany the blood vessels, a pulmonary arteriosclerosis, and as such individuals are old enough to have more or less arteriosclerosis of the coronary arteries, with resulting cardiac impairment, symptoms of heart failure may be the first ones noted by the patient. However, the breathlessness which is so often the first complaint may, in part at least, be due to insufficient oxygenation of the blood in the fibrosed lung. The treatment in these cases should be directed at the heart, and should be similar to that used in arteriosclerotic heart disease with emphysema of the lungs. Every effort should be made to keep the erythrocytes and hemoglobin normal, as an associated secondary anemia would aggravate the symptoms.

TO SUMMARIZE, in the treatment of pneumoconiosis: (1) prevention of exposure to silica-containing dusts in concentrations of more than 20,000,000 particles of dust per cubic foot of air is of utmost importance; (2) prevention of tuberculosis ranks next; (3) then prevention or active treatment of acute and chronic upper respiratory infections; and last (4) symptomatic treatment of the associated or secondary pathoses. Little can be accomplished by active curative therapy; much by preventive. The industries involved are making every practicable effort to reduce or eliminate the dust hazard.

Excessive Prescribing Under Insurance

A DISCUSSION of the report of the chief medical officer for 1935* contains the following comments on the excessive prescribing under the English insurance system:

"In the section on the Insurance Medical Service, which provides medical benefit for nearly 16 million people in England and Wales through some 16,600 medical practitioners, attention is again drawn to the great increase in the number of prescriptions issued, an increase which is not accounted for by any known fact relating to the incidence of disease in the country. Not only is there no contention that the expenditure of some two and a quarter million pounds on the provision of medicine is necessary or desirable, but on the contrary it has been repeatedly stated by representative practitioners that a very large proportion of the present physicking of the population is wholly unnecessary, and that if all doctors felt themselves free to order only such medicinal treatment as in their unfettered professional judgment they considered necessary, the total cost of prescribing would at once fall spectacularly—as far, some assert, as to half its present dimensions."

The most significant portion of this statement is in the final clause, implying that doctors do not "feel themselves free to order only such medicinal treatment as in their unfettered professional judgment they considered necessary." Sickness insurance has transferred the function of prescribing from the physician to the patient and has developed a system of self medication which must be encouraged by the physicians themselves if they are to retain their panel patients.

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* *J.A.M.A.*, October 30, 1937, referring to *Public Health*, 50:112 (January) 1937.